VOL. XVII. No. 12 DECEMBER 1932

MECCANO MAGAZINE

MAGNETIC CAR TO TRAVEL 600 M.P.H.
(see page 910)

6D.

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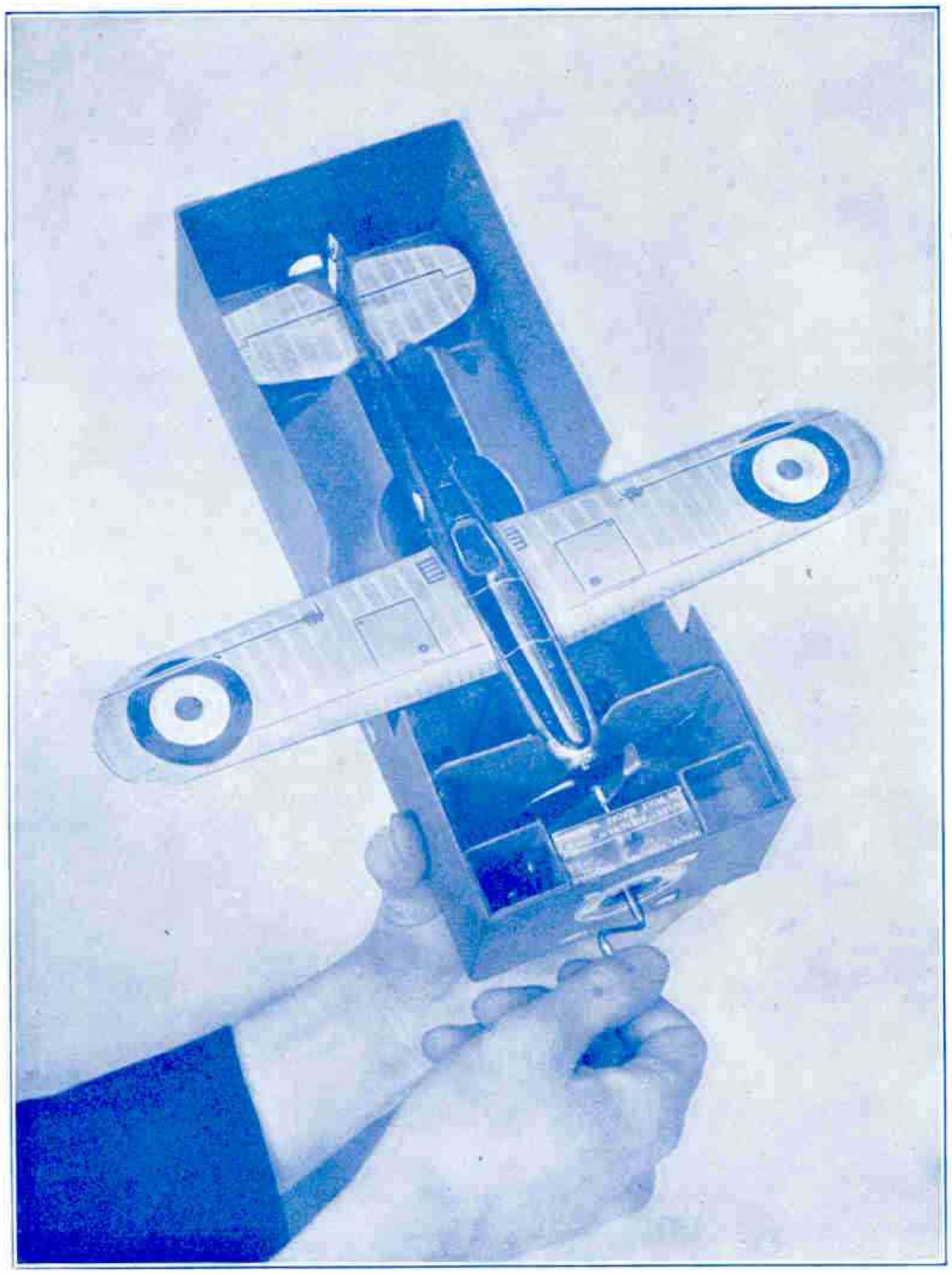

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MECCANO MAGAZINE

Editorial Office:
Binns Road
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Vol. XVII. No. 12
December, 1932

With the Editor

A Merry Christmas to all my Readers!

Once more we are approaching the end of the year, and most of you will be busily engaged in preparations for Christmas, and thinking of the splendid time you will have three weeks hence. I send you all my sincere wishes for a Very Merry Christmas—the best you have ever had!

At Christmas, more than at any other time of the year, I realise how world-wide is the circle of my readers. My Christmas mail brings me good wishes from almost every civilised country, and as I read them my thoughts travel round the world and I try to imagine my correspondents in their homes. Many of them live in countries that are now fast in the grip of winter, others are sweltering in tropical heat; but my letters show that everywhere there exists the wonderful Christmas spirit of goodwill.

The "Old Fashioned" Christmas

The vagaries of British weather give rise to many grumbles, but at any rate they serve the purpose of providing an unfailing topic of conversation. On Christmay Day, if it does not freeze or snow, thousands of people in all parts of the country will be sure to say that the winters are not what they used to be. This is far from being a modern complaint, for in 1853 a writer referred to what he called "one of the old-fashioned winters," as if the frost and snow of Christmas were even then a thing of the past. Similar thoughts seem to have been in the mind of Samuel Pepys, the famous diarist, when he remarked on 7th December, 1662, "at my waking I found the tops of the houses covered with snow, which is a rare sight that I have not seen these last three years."

Young people are inclined to laugh at the idea that frost and snow, with their attendant delights of skating and snowballing, were once regular Christmas fare; but there really are grounds for believing in the "old-fashioned" winter. A little over 200 years ago "Frost Fairs" were held on the River Thames. On many occasions about that time, notably in 1683–84, 1715–16, and 1739–40, the ice was strong enough to bear the weight of swings, coconut shies, and other fairground delights. Booths were erected for the sale of all kinds of good things to eat and drink, and games such as skittles were played on the ice, the inevitable falls of the players causing great hilarity among the spectators. Those who ventured on the frozen river were able to warm themselves at huge fires that were kept going, and which provided light for skating at night. Frequently an ox was roasted whole at one of these fires and carved into slices with great ceremony; and souvenirs were on sale in the form of engravings and ballads that were actually printed by hand presses set up on the ice. The scene is well depicted in the illustration.

An old-time "Frost Fair" on the frozen River Thames.

Buy British Goods!

A year ago I pointed out that there were in this country something like 2,500,000 men and women who, through no fault of their own, were unable to find work. Since then, unfortunately, the number of unemployed has increased still further, for during 1932 world trade has been sadly restricted and conditions everywhere have remained critical. It is gratifying to know that there is now hope of improvement, however. Many experts are confident that 1933 will witness a great revival in trade and a return of prosperity, and I am sure my readers will join me in the hope that these forecasts will prove to be accurate.

There is one way in which we can all play a part in hastening the return of prosperity in this country, and that is by resolving always to choose British goods in preference to those made abroad. To do this is wise as well as patriotic, for British goods have an unassailable reputation for sound workmanship, and a proportion of their cost represents wages paid to our own countrymen. From now until Christmas every reader will have opportunities of putting this suggestion into practice, and I hope that the slogan "Buy British Goods!" will be kept specially in mind on all shopping expeditions during the present month. Doubts regarding the origin of any article may easily be settled by means of a direct enquiry.

Sixteen Years' Progress

It is 16 years since the *"M.M."* made its first appearance, in the humble form of a four-page leaflet; this month's issue numbers 112 pages. Looking back over the years during which this remarkable growth has taken place, I feel that the policy of the *"M.M."* has been abundantly justified. This policy was based on the firm belief that vast numbers of boys were interested in the real things of the world around them, and cared little for fiction. Many people said that a boy's magazine could not succeed without hair-raising stories of adventure; yet the *"M.M."*, dealing with engineering, railway, aviation, shipping and scientific topics, has grown steadily year by year in both size and circulation.

One of the pleasantest features of my Editorship has been the close touch I have been able to maintain with my readers by means of regular correspondence. Many boys will now be making their first acquaintance with the *"M.M."* In taking this opportunity of welcoming them as new readers, I invite them to write to me from time to time, telling me about their everyday lives, their hopes and ambitions. In other words, I want every reader of the *"M.M."* to regard the Editor as a personal friend, with whom they can correspond in a spirit of real comradeship.

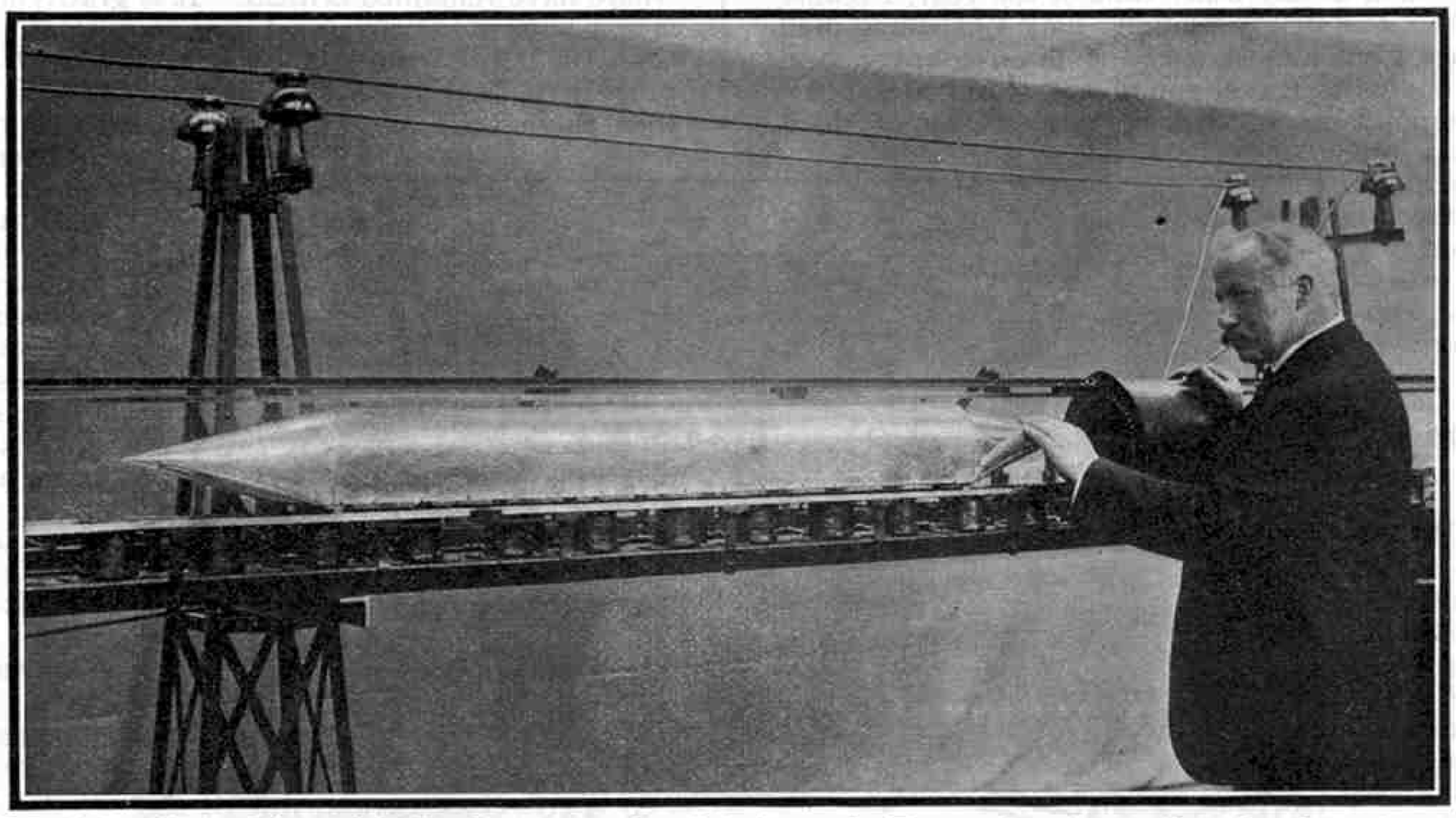
High Speed Trackless Railways

Electro-Magnetic Propulsion at 600 m.p.h.

By H. F. Kutschbach

ONE of the greatest enemies of the transport engineer is friction, for this opposes the movement of all vehicles supported on wheels, whether they run on rails or on road surfaces, and reduces their speeds very considerably. If this friction could be abolished, less powerful engines than those employed to-day could be used to give greater speeds than are now possible, and there would be considerable saving in the cost of repairs as well as in constructional expenses.

The desire to abolish friction has led to the invention of many interesting forms of locomotion. Early in the present century the mono-rail car was introduced by Mr. Louis Brennan. This was a coach of the ordinary type, driven electrically, but it differed from the vehicles employed on ordinary electric railways in running on a single rail instead of on two. The car was balanced on its single line of wheels by means of two gyroscopes. The heavy flywheels of these gyroscopes rotated extremely rapidly, and their property of keeping their axes pointed in a given direction enabled them to restore instantly the level of the car when this was tilted. Very high speeds were attained with perfect safety on this railway, and wear and tear was reduced considerably by the abolition of the second rail.



M. Bachelet with a working model of the electro-magnetic train he invented. The car is resting on the poles of the electro-magnets and one of the solenoids is shown on the right. Our photograph is reproduced from "Electricity," by W. H. McCormick, by permission of the publishers, T. Nelson and Sons Ltd.

Other inventors have tried to eliminate friction and to avoid other defects of ordinary locomotion by using cars suspended from overhead rails. A striking instance is the well-known electric railway that runs between Elberfeld and Barmen, in Germany. This is an overhead system that for part of the distance covered is constructed above a river, and it may be described as a large scale development of the electric telpher dealt with on page 834 of the *"M.M."* for November, 1929. The cars are suspended from trolleys that run on a single rail, the driving motors being carried by the trolleys; and the reduction of frictional resistance enables high speeds to be attained on this remarkable transport system with the use of comparatively low power.

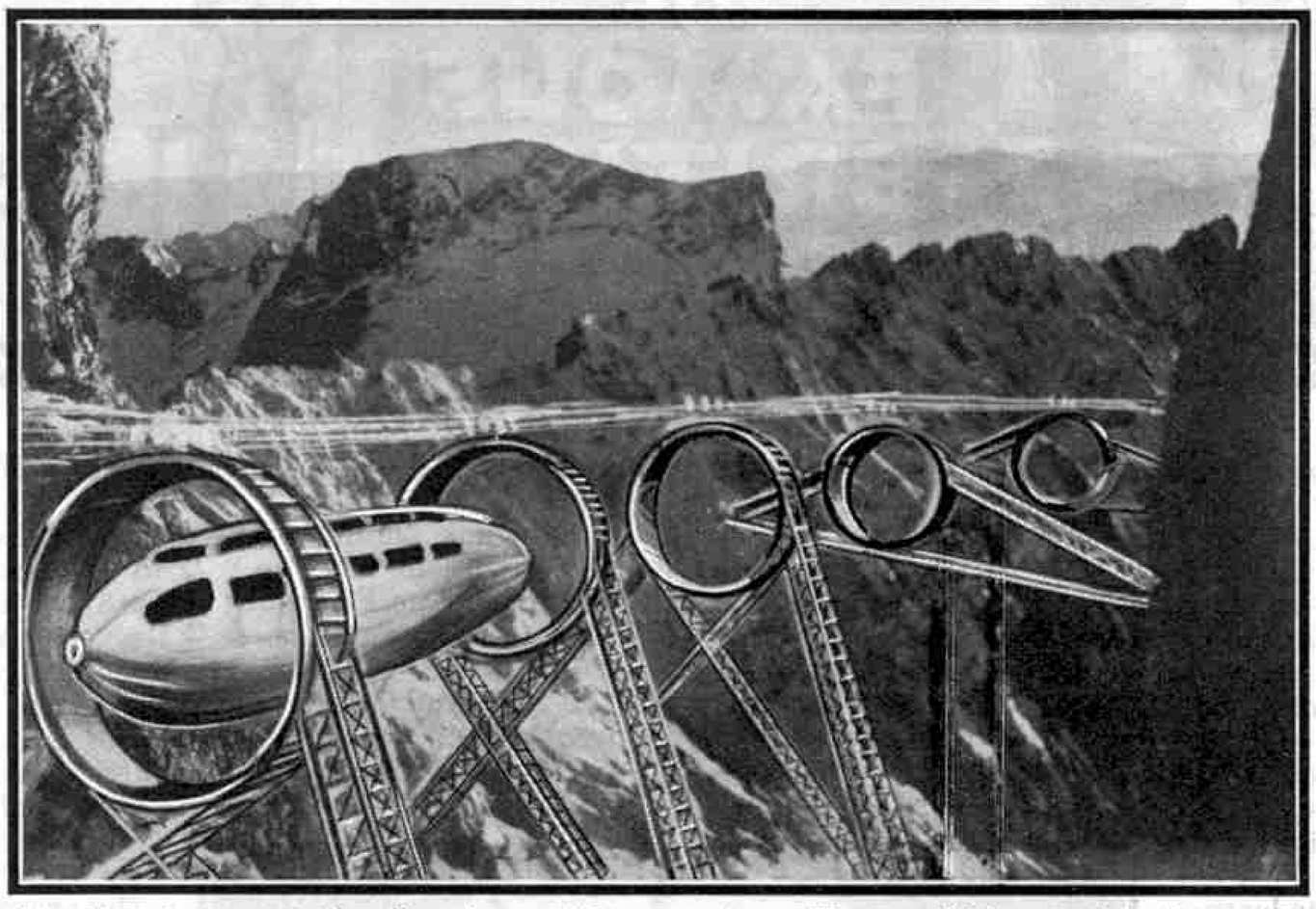
An overhead railway of more than special interest is the Bennie "Railplane," which was fully described and illustrated in an article on page 594 of the *"M.M."* for August, 1930. The long cigar-shaped vehicles designed by Mr. Bennie are suspended from two-wheeled bogies running on an overhead rail carried on trestles or columns, but differ from those of previous overhead railways in the use of airscrews to drive them. These airscrews are actuated by electric motors, carried in the cars themselves, that are supplied with current from a conductor rail. Thus the wheels on the overhead rail merely act as supports.

At the speeds at which the cars of the Bennie "Railplane" are driven a lifting action similar to that of an aeroplane is brought into operation, and this has the effect of diminishing frictional losses by reducing pressure on the rail. Ball and roller bearing devices also are freely used, and Mr. Bennie claims that on the "Railplane" friction could be reduced to 5 lb. per ton of load. With an average horse-power of 120, a speed of 120 m.p.h. could be attained on the level.

The adoption of the Bennie "Railplane" would greatly reduce the initial cost of railway building, and there would be little difficulty in bridging wide estuaries and other stretches of water by means of the system, for all that would be necessary would be a series of trestles to support the single rail from which the cars are suspended. A further advantage is that undulations of the ground could be followed, for the cars are capable of ascending or descending gradients much more severe than those met with on ordinary railways.

An interesting effort to overcome difficulties due to friction was made immediately before the Great War by a French inventor named Bachelet, whose system differed entirely in principle from those already described. Bachelet made use of the discovery, due to Professor

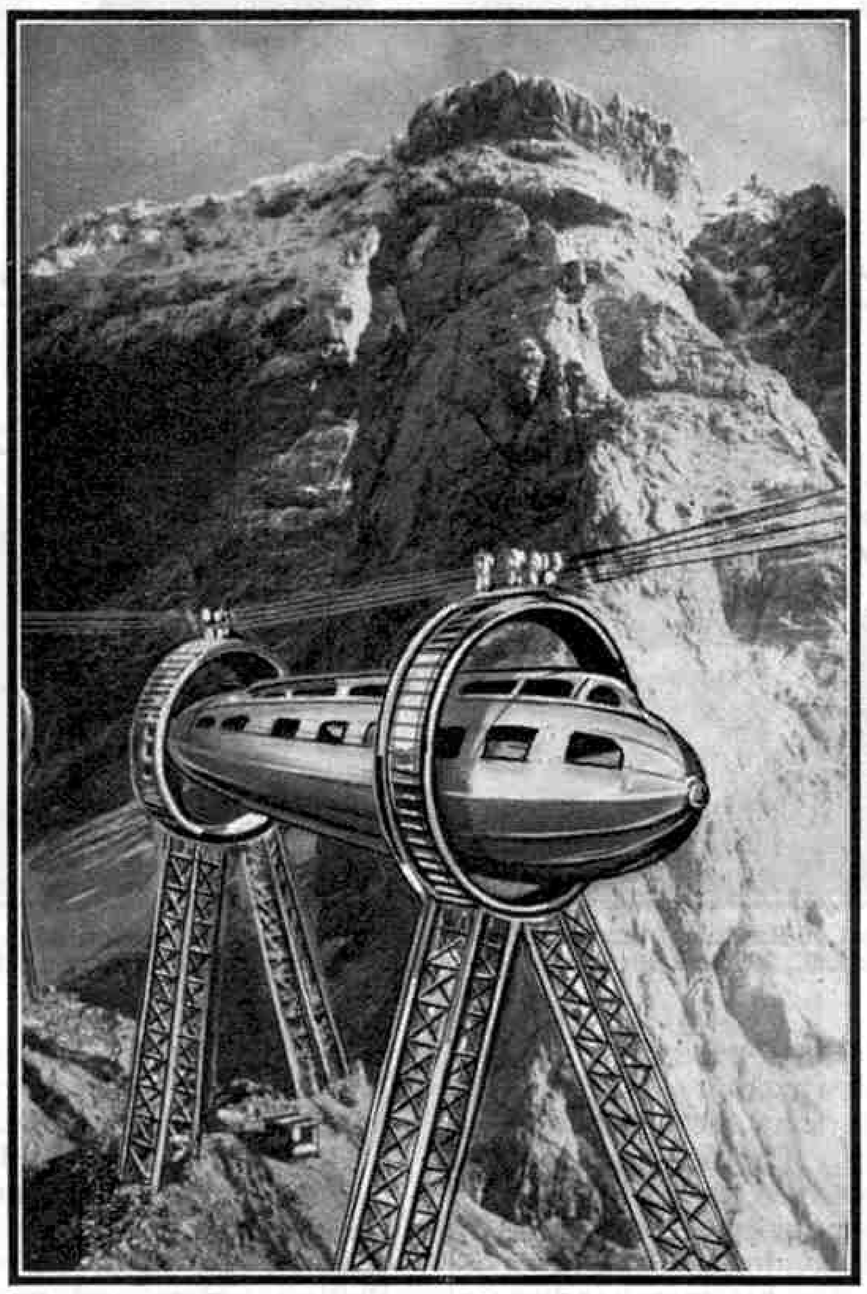
Elihu Thompson, a famous American scientist, that a plate of copper, brass or aluminium was momentarily repelled by an electro-magnet when the current was turned on, and attracted when the current was stopped. These metals are not magnetic, and the attraction and repulsion are not ordinary magnetic effects but are due to currents induced in the plates at the instant of producing or destroying the electro-magnetism. The effects are shown equally well if the magnet is excited by means of alternating current, for this changes its direction very rapidly, and thus changes the magnetism also. The repulsive force is much more powerful than the attraction, and when a powerful and rapidly alternating current is used the plate is repelled so strongly that it remains supported in mid-air above the pole of the electro-magnet.



A trackless electro-magnetic railway in mountainous country. The cars of this suggested railway of the future would attain speeds of 600 m.p.h.

Bachelet employed a track made up of a continuous series of electro-magnets actuated by alternating current. The car, which was roughly cigar-shaped, had a floor of aluminium and contained an iron cylinder. It ran along the line of magnets and was kept in position by means of three channel guide rails, one at each side of the track and a third overhead, in which ran brushes fitted with guide pieces. These guide rails also acted as conductors for the current.

So long as the electro-magnets remained unexcited the car rested on the track, but the repulsive action produced on the aluminium floor when the current was switched on raised it clear of the track and kept it suspended. While in this mid-air position the car was pulled forward by powerful solenoids energised by direct current. These solenoids act like magnets, and when the car entered one of them the iron cylinder was attracted by it, and thus the car was given a forward movement that was sufficient to carry it along to the next solenoid. There the pull was repeated, and so the car was drawn forward from one solenoid to another to the end of the line.



Another view of the proposed trackless railway described in this article.

A model of Bachelet's invention was constructed on such a scale that a child could be seated in the car, and the trials that followed were successful. It was unnecessary to energise all the electro-magnets and solenoids at once, and they were divided into sections, the alternating and direct currents employed being automatically switched on as the car approached the beginning of a section, and cut off as it left. Extraordinary speeds were attained, and the inventor looked forward to reaching speeds of more than 300 m.p.h. in actual practice.

Since the trials of Bachelet's invention the aeroplane and the airship have become familiar means of travel. Friction is of comparatively small importance in air transport. The machines employed must be self-contained power units, however, and the provision of reliable engines for them not only involves heavy expense, but also complicates matters by adding considerably to the weight to be carried, and thus to the power necessary. A further difficulty is that repairs and replacements are impossible during travel, and this adds to the risk of accident. In these respects a railway built on the principles employed by Bachelet would be more satisfactory. The power necessary could be supplied from large central power stations, and instead of engines the cars would only need to be equipped with iron cylinders and plates of aluminium or some other non-magnetic metal, which could be incorporated in the constructional details. The electro-magnets and solenoids that support the car in the air and pull it forward respectively would be stationary, and therefore easy to reach for adjustment or repair. A further advantage of a line of this kind would be the ability to work on gradients more severe than those of ordinary railways, so that it would be unnecessary to build embankments or excavate cuttings and tunnels in its construction.

The ease with which electric railways employing the Bachelet system may be built, and the great speeds possible on them, have led to a revival of the idea in Germany. The engineers responsible for this revival think that the electro-magnets actuated by means of alternating current may be dispensed with, and that the pull of the solenoid would supply the power necessary to maintain the cars in position above the ground as well as to draw them forward through the air. Thus the new lines would have no track. It would be necessary to

(Continued on page 952

III.—SIR JOHN HAWKINS

THE sea adventures of Sir Francis Drake whose thrilling life-story was told in the *"M.M."* of October last, were shared on one or two occasions by Sir John Hawkins, another and equally famous British admiral.

John Hawkins was born at Plymouth in 1532, and was the second son of William Hawkins, a wealthy merchant and ship-owner, who in his seafaring days had been the first Englishman to visit Brazil. The boy inherited his father's love of the sea, and at an early age showed a keenness for mathematics and navigation. While still a youth he went to sea and by the time he was 30 years of age he had made several voyages to Spain and Portugal.

During these trips Hawkins learned a good deal about the Spanish slave traffic, and found that slaves could easily be obtained on the coast of Guinea and sold at great profit at Spanish ports in the West Indies. In those days this trading was looked upon as quite permissible, and although there was a Spanish law prohibiting foreigners from taking part in the traffic, Hawkins decided to try his luck. He had no difficulty in raising the necessary funds, for he had already gained a reputation as a successful merchant and a skilful navigator, and three small private vessels were soon got ready.

The expedition sailed from England in October, 1562, and consisted of the *"Solomon"* of 120 tons, commanded by Hawkins; the *"Swallow,"* 100 tons, and the *"Jonas,"* 40 tons, the crews of this little fleet totalling about 100 men. At Teneriffe Hawkins' friendship with a merchant there enabled him to take on board a Spanish pilot to guide the expedition, and Sierra Leone was reached without mishap. Here Hawkins obtained by purchase or force 300 negro slaves and a quantity of merchandise. He then sailed across the Atlantic to Hispaniola, where he sold the negroes at great profit, receiving for them such large quantities of sugar, ginger and hides that he had to charter two ships to accommodate some of these goods.

Portrait of Hawkins from a contemporary print in the possession of T. H. Parker Ltd., 28, Berkeley Square, London, by whose courtesy we are enabled to reproduce it.

Hawkins did not take these extra ships back with him to England, but sent them to Cadiz, Spain, in the hope that they would be able to sell their cargoes there at a good price. He took too much for granted, however, for when the ships arrived at Cadiz their cargoes were seized by the Spaniards as smuggled goods. The original three ships of the expedition reached London in September 1563, and Hawkins found a ready market for his merchandise, but the great profit he made was offset by the loss of the two ships he had sent to Spain.

Hawkins had not intended to offend the Spaniards by his trading, and he protested strongly against the action of the King of Spain in seizing the two ships, and prevailed upon Queen Elizabeth to write to Philip asking for redress. Philip, however, saw in Hawkins' successful voyage the beginning of an enterprise that would ruin Spain's monopoly of the slave trade, and he refused to make any compensation. Instead he severely rebuked the Governor of San Domingo for allowing Hawkins to trade, and forbade the Spaniards in the West Indies to trade at all with Englishmen.

Hawkins planned a second expedition, however, and for this Elizabeth lent him the *"Jesus of Lubeck,"* a 700 ton man-of-war. He sailed from Plymouth on 18th October, 1564, his fleet consisting of the *"Jesus of Lubeck,"* the *"Solomon,"* the *"Swallow,"* and the *"Tiger,"* a 50-ton vessel. The crews of these ships totalled 170 men and boys. Voyaging south, the ships encountered bad weather and were forced to shelter for five days at Ferrol, a Spanish port. Eventually they reached Teneriffe again, and remained there a fortnight to re-provision the ships and repair damage received by the *"Jesus of Lubeck"* during the storm off Spain.

From Teneriffe Hawkins sailed to Cape Verde Island where he found that the *"Minion,"* a ship belonging to the Queen, which he had met shortly after leaving Plymouth, had preceded him at the island and made known the object of his voyage. He was thus unable to obtain any slaves there, but he made several successful raids on unsuspecting places on the coast of Guinea. By the 29th January, 1565, sufficient slaves had been captured, and the expedition sailed to the West Indies.

The ships were crowded with sailors and slaves and it was not long before the water supply ran short. To make matters worse they were becalmed in the Atlantic for almost three weeks, and the situation had become critical by the time a favourable breeze sprang up and enabled them to make headway again. Dominica, then a cannibal island, gave them an opportunity to replenish their water supply, and they arrived at Margarita, an island off the coast of Venezuela, on 16th March, 1565. There Hawkins met with further trouble, for the Governor of the island refused to trade with him or even to permit him to land, and lost no time in sending a fast messenger to the Viceroy of the West Indies at San Domingo, warning him that "Hawkins of Plymouth" was in the vicinity. The Viceroy at once repeated Philip's strict orders to all the Spanish settlements, and thus Hawkins was forestalled.

Hawkins endeavoured to trade with Spaniards on the mainland, but they would have nothing to do with him. On 3rd April he anchored at a Spanish settlement close to what is now Puerto Cabello, but when he went ashore the local governor repeated Philip's orders and requested him to depart. Hawkins replied that he could not comply with this request as he was in command of one of the "Queen's Armadoes of England," and needed food and money to provide for the many troops that he had on board his ships. After much haggling the Governor allowed the ships to enter the harbour and provided food for the troops, but he would not permit any slave trading.

At last the patience of Hawkins became exhausted and he decided to take the law into his own hands. On 16th April he landed 100 men clad in armour and armed with bows and arrows and pikes. This display of force had the desired effect, and

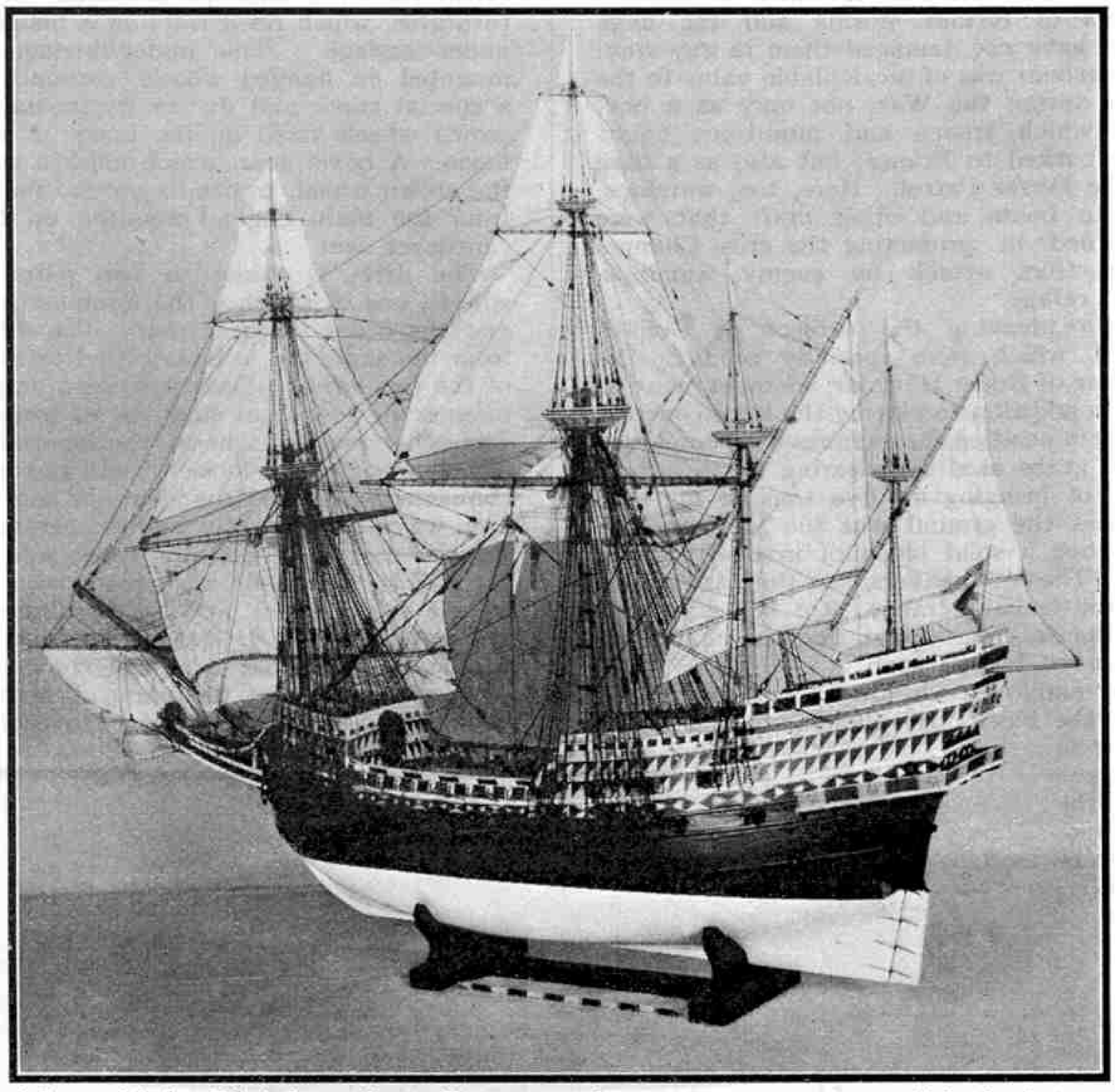
to avoid bloodshed and the possible burning of the town the Governor gave way and allowed Hawkins to trade with the inhabitants.

At Rio de la Hacha, on the coast of Colombia, Hawkins again had trouble with the Spaniards. Finally he fired a gun to announce the end of peaceful negotiations, and with 100 armed men rowed ashore in boats equipped with small guns. The Governor quickly mustered a force of 30 horsemen and 150 foot soldiers and marched down to the beach. Hawkins opened fire with two light guns and the Spaniards promptly retreated to safety. Finally the Governor declared a truce and allowed Hawkins to carry on his trading activities. The expedition later visited Jamaica, Cuba and Florida, and in the St. John River region came across the survivors of a colony of Huguenots who purchased from Hawkins the barque "*Tiger*" to enable them to return to Europe. The ships then sailed homeward and reached Padstow, Cornwall, on 2nd September, 1565. The rich cargoes he had brought further enhanced Hawkins' reputation, and he found himself a national hero and in good favour with Elizabeth.

The King of Spain was naturally greatly enraged at the activities of Hawkins, and Elizabeth found it prudent to prohibit further voyages for the time being. Hawkins did not give up the idea of further slave trading, however, and in 1567, finding that Elizabeth was no longer inclined to restrain him, he lost no time in arranging another expedition to the Spanish colonies. On 2nd October, 1567, this expedition sailed from Plymouth, the fleet consisting of the "*Jesus of Lubeck*," commanded by Hawkins, the "*Minion*" of 300 tons, and four merchant ships, one of which, the "*Judith*," of 50 tons, was commanded by Drake. Once again Hawkins was successful in obtaining by forceful means a cargo of negro slaves, and he then sailed from Guinea to the West Indies. Readers of our article on Drake will recall that while the ships were in the harbour of San Juan de Ulloa, now known as Vera Cruz, they were treacherously attacked by a Spanish fleet. Only the "*Judith*" and the "*Minion*" escaped, and these two ships soon lost touch with each other. The "*Judith*" reached Plymouth Sound on 20th January, 1569, and the "*Minion*" with Hawkins on board reached Mount's Bay, Cornwall, five days later. The "*Minion*" had been so damaged during the fight, and became so short of provisions, that 100 of the crew and other survivers had been landed on the Mexican coast at their own request, as they were certain that the ship would never reach England.

The failure of the expedition and the heavy loss in ships and men brought Hawkins into disfavour at Court, and when he proposed another expedition to recoup his losses Elizabeth would not assist him. At length increasing friction between England and Spain gave him the opportunity that he desired. Pretending to be one of a number of Englishmen dissatisfied with Elizabeth's government, he asked the Spanish Ambassador to intercede for him with the King of Spain, in the hope of obtaining the release of the men left behind in Mexico. Hawkins gave the Ambassador the impression of being ready to enter Phillip's service and to take over to Spain the pick of the English fleet and seamen. This pretence to be a traitor to the Queen succeeded, and Philip sent him £40,000 to enable him to equip the promised ships, conferred on him Spanish titles, and released some Englishmen imprisoned in Seville. Hawkins gladly accepted the money but did not prepare the ships, for he regarded the payment as just compensation for his heavy losses during his unfortunate expedition. He sent to Lord Burghley, the Queen's most trusted adviser, a copy of Philip's pardon, and remarked that it had been granted "with very great titles and honours from the King, from which God deliver me. Their practices be very mischievous, and they be never idle; but God, I hope, will confound them and turn their devices on their own necks."

The misfortunes of his last expedition apparently discouraged Hawkins for a time, and he spent the next few years at home. In 1572 he became Member of Parliament for Plymouth, and in 1573 he was appointed Treasurer and Comptroller of the Navy, and held this important office until the end of his life. Some time after taking up this appointment Hawkins had a narrow escape from being assassinated in mistake for someone else. One day in the Strand a man named Birchet, who had formed an insane desire to kill Hatton, the Queen's Vice-Chancellor, mistook Hawkins for the Minister and stabbed him. Fortunately the blow was not a fatal one, and Hawkins was able to disarm his assailant and secure him. Birchet was taken to the Tower, where in a fit of frenzy he attacked and killed the keeper. He was afterward tried and condemned to death, and was executed on the spot where he had attempted to murder Hawkins.



A fine model of an Elizabethan galleon. The enormous forecastle and sterncastle were distinctive features of these sailing ships. This photograph is reproduced by permission of the Science Museum, London.

Under the experienced guidance of Hawkins many improvements were effected in the building and rigging of the Queen's ships, and by the time it became known that Spain was preparing her great Armada the English Navy was well equipped and organised. The interesting circumstances that marked the opening of the great fight with the Spanish Armada were told in our story of Drake. Hawkins was Rear-Admiral on the "*Victory*," and took an active part in the various engagements with the Armada. In company with Martin Frobisher and others he was afterward knighted on the deck of the "*Ark Royal*" on 25th July, 1588.

In 1590 Sir John Hawkins and Sir Martin Frobisher, each commanding five men-of-war, were sent to intercept the Spanish treasure fleet from the West Indies as it neared Spain, but Philip heard of their departure and sent instructions to the treasure fleet to remain in port. This action by Philip deprived the Englishmen of victory, but it emphasised the end of Spain's reputation as a maritime power.

It was evident that nothing disturbed the Spaniards so much as attacks on their colonies, and in 1595 Drake and Hawkins proposed to the Queen that they should undertake another expedition. Briefly the scheme was to sack Nombre de Dios, march overland to Panama, and there seize the treasure brought from Peru by the Spaniards. The Queen readily approved of the scheme and provided a squadron of warships. Drake was given charge of the expedition, and Hawkins accompanied him as second in command. The fleet consisted of 27 ships, and sailed from Plymouth on 28th August, 1595.

A brief call was made at Dominica, and the voyage was resumed on 30th October. In the evening of that day the "*Francis*," a barque of about 35 tons and the rearmost of Hawkins' ships, encountered five Spanish frigates and was captured. This unfortunate occurrence greatly depressed Hawkins and, combined with the unhealthy West Indies climate, which had already spread sickness among the men, broke his health and he died on 13th November, 1595. Shortly afterward Drake also died, and these two disasters caused the expedition to abandon its attempt and return to England.

How the Engineer holds back the Sea

II—Breakwaters and Harbours

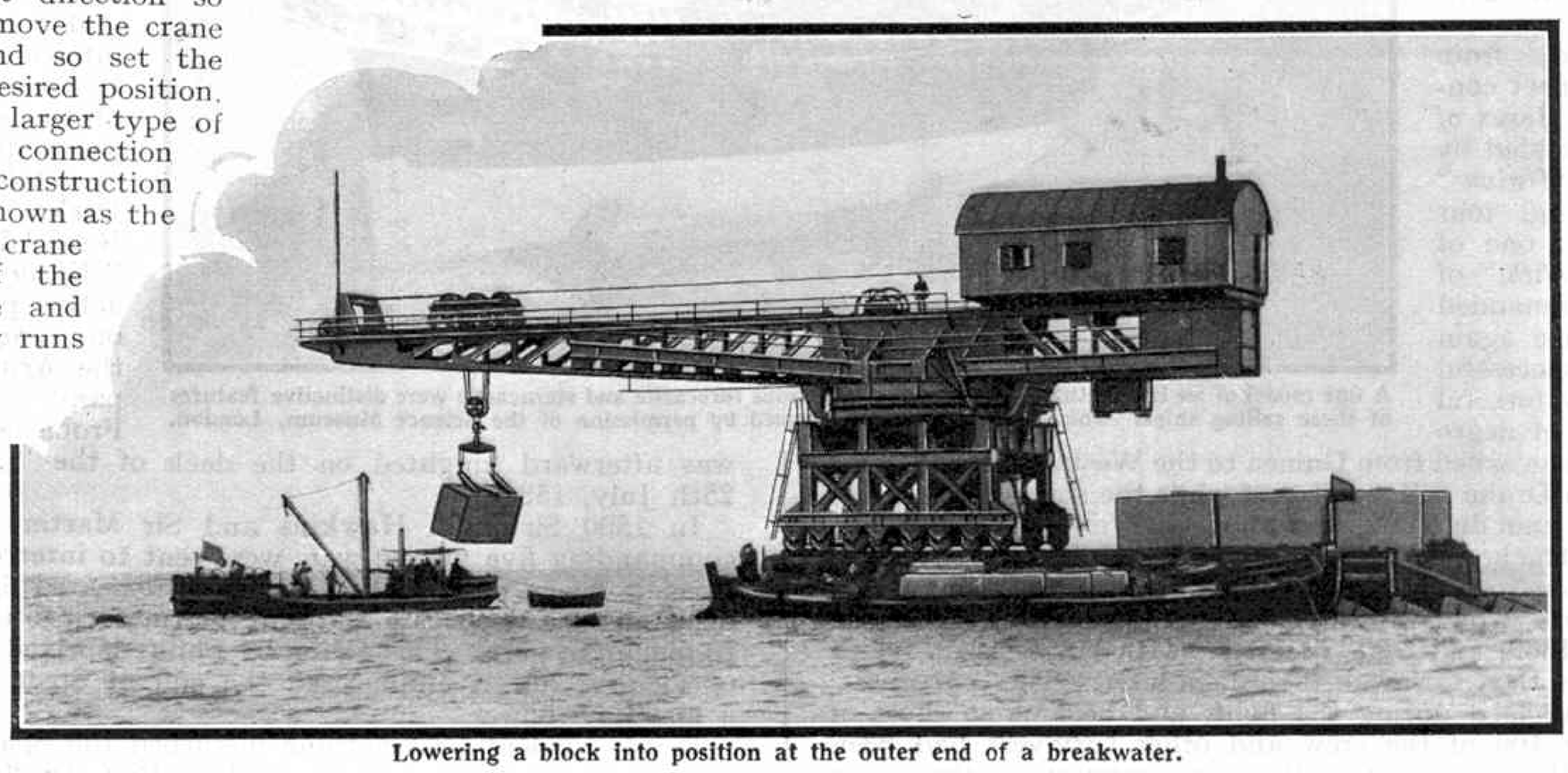
Fidler's gear ready for attaching to a concrete block.

IN the Dover Harbour we have an excellent example of how, for the time being, man has won a victory over the sea. The great breakwaters have withstood winters of furious storms and the huge waves have not damaged them in any way. The harbour was of incalculable value to the Allies during the War, not only as a port from which troops and munitions might be embarked to France, but also as a base for the Dover Patrol. Here, too, warships, torpedo boats and other craft that were concerned in protecting the cross-Channel traffic from attack by enemy warships, found refuge.

Before leaving the subject of Goliath cranes, which were specially used in the building of Dover Harbour, we must mention that in addition to placing the huge concrete blocks in position these cranes were employed to operate huge clam-shell grabs used for clearing the sea-floor. These grabs were capable of bringing up five tons of material at a time. In many places the ground was too hard for the grabs to get a bite, and then a solid block of iron with three projecting teeth was used. These "breakers," as they are called, were also operated from the Goliath cranes. On being lowered at speed they crashed to the sea-floor, splintering the chalk into large pieces that were gathered by the grab.

The Goliaths were also employed to lower the diving-bells from which the divers set the blocks, telephoning to the crane-man the exact direction so that he could move the crane as required and so set the block in the desired position.

Another and larger type of crane used in connection with harbour construction work is that known as the "Titan." This crane has a jib of the cantilever type and the load trolley runs along its upper boom, the whole jib turning on a live ring in a similar manner to that of the large jib cranes. Usually the Titan crane is steam operated, although cranes have been made for use with electric power where current is available.



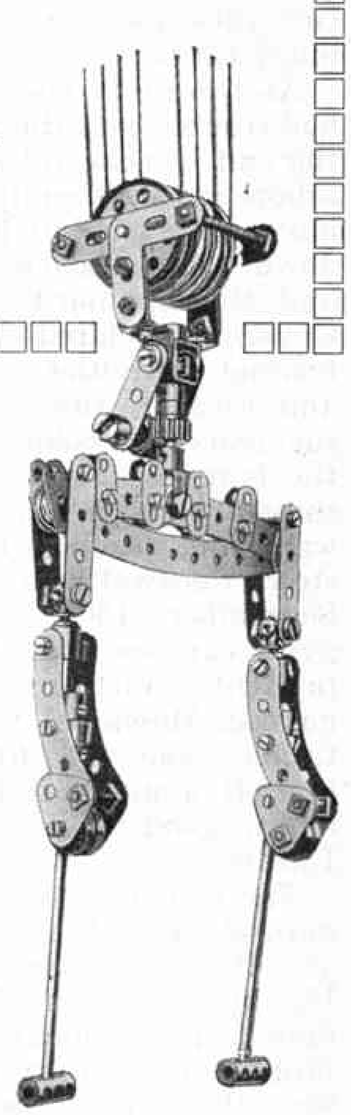
Lowering a block into position at the outer end of a breakwater.

Titan cranes are frequently constructed of such a size that they weigh 500 tons or more and they have been built to operate loads up to 60 tons. This type was evolved when the block system of breakwater construction came into general use. As is the case when Goliath cranes are employed, the concrete blocks are cast in special yards near the scene of operations and are wheeled on special trucks along the pier or gantry to a position near the crane. This picks up the blocks and swings them out into the position in which they are to be fixed in the breakwater. The blocks are then keyed together, as has already been explained, in order that they may present a solid front to the devastating action of the waves.

The Titan crane has the advantage of being mobile, so that it is possible to move it along the pier as the construction of a breakwater proceeds. Even more important is the fact that it is also practicable to withdraw it shorewards for shelter in bad weather.

These cranes are capable of handling concrete blocks over a radius of 100 ft. or more. They do this by means of the long cantilever arm that is mounted on a turntable, which itself rests on a massive under-carriage. The under-carriage is mounted on flanged wheels, running on a special track and driven by means of crown wheels fixed on the inside of the bogie. A bevel gear, which meshes with the crown wheel, transmits motive power from the main engine mounted on the cantilever arm.

The drive is taken to two pairs of wheels, one of which is the foremost pair and the other the rear pair. The drive from the same rod is transmitted to each of the two crown wheels in a very simple manner by means of small bevel wheels. The other pairs of wheels, the innermost on each bogie, are loose wheels and not connected with the driving mechanism in any way. An exactly similar arrangement is carried out on the other side of the track, the front and rear pairs of wheels being driven, and the two inner pairs being loose.



Meccano model of Fidler's gear for comparison with the original opposite.

The practice of driving four wheels out of eight on each side of the track is simply one of convenience and depends largely upon the weight of the crane. In the lighter cranes it is not necessary to have four wheels to each bogie.

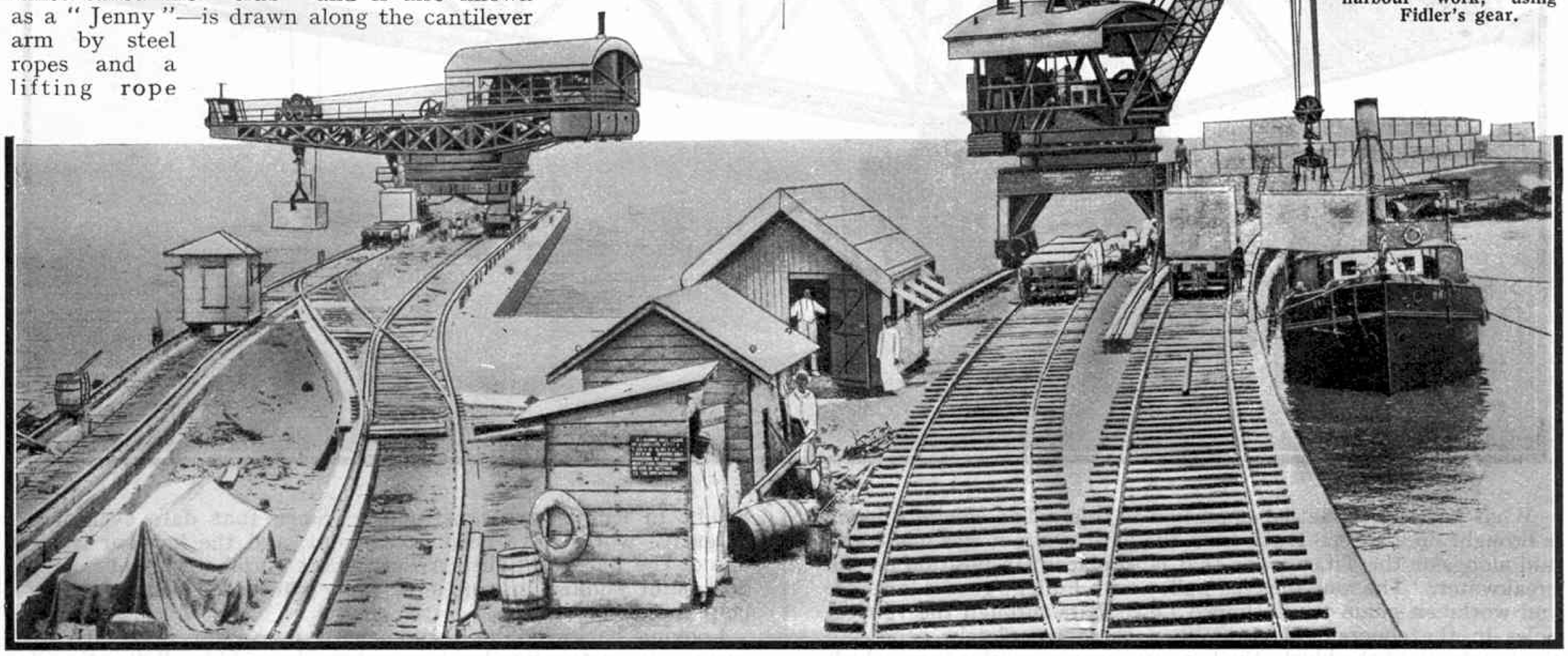
The cantilever arm and superstructure of all Titan cranes revolves on a ring of live rollers, which in the case of a large crane may have a path of between 30 and 40 ft. in diameter. The bearings are formed by a series of turned steel rollers held in position by a suitable frame and revolving on machined pathways between the upper and lower circular girders. The ends of the rollers can just be seen, in the accompanying illustration of a Meccano model of a large block-setting crane, immediately below the lower framework of the cantilever arm where it rests upon the massive metal mounting.

The whole of this revolving structure is centred by means of a large central pivot, consisting of a steel rod of considerable diameter. The revolving motion is transmitted from the engine, or—in the case of an electrically-equipped crane—from the electric motor, which occupies a corresponding position on the opposite end of the cantilever arm to that from which the load is operated. The weight of the engine or electric motor helps to balance the load, but it alone is not sufficient. A massive weight has also to be introduced to act as a counterpoise, and it is placed immediately beneath the engine housing.

The motion from the engine is transmitted through a chain of spur- and bevel-gears, which finally engage in the segmental spur track, formed around the exterior of the roller path. In

some cranes the gears are thoroughly protected from the weather by covering them with heavy metal casings, but this is not always found necessary.

As previously explained, the same engine drives the travelling motion of the crane in a similar manner by rod and gearing. The gears are engaged or disengaged by the engine-man, who, of course, also controls the hoisting and lowering of the load and the movements of the trolley. This trolley—which is sometimes called the "crab" and is also known as a "Jenny"—is drawn along the cantilever arm by steel ropes and a lifting rope



An interesting photograph showing two types of Block-setting Cranes. On the left the Titan using friction grip for lowering the block, and on the right a Jib Crane specially constructed for harbour work, using Fidler's gear.

4 in. in circumference passes over it to the hoisting block. The lowering arrangements in the crane illustrated are controlled by a patent system of hydraulic brakes, which enable the heaviest weights to be lowered within limits of a fraction of an inch with absolute precision.

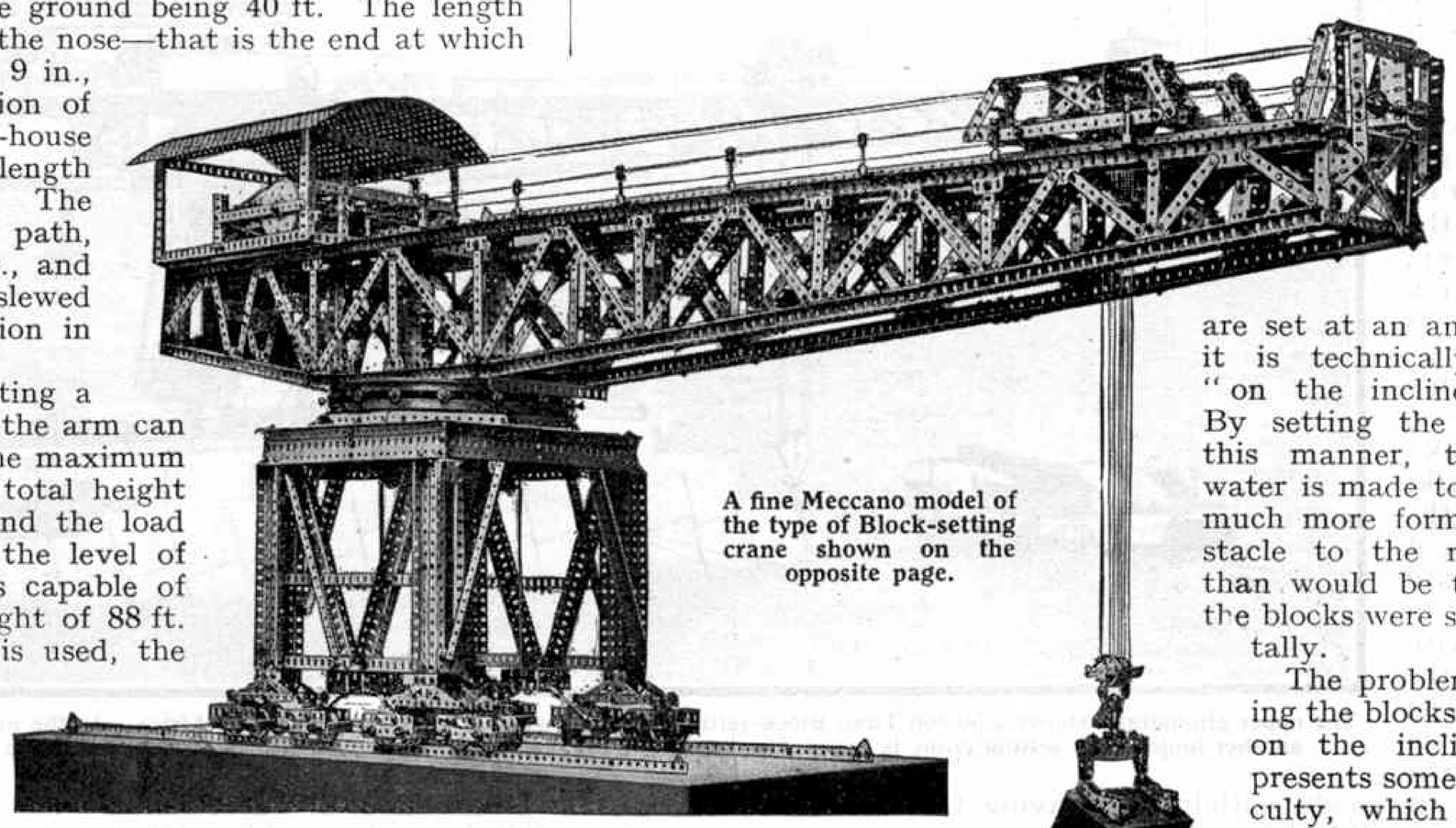
A splendid example of the Titan type of crane is one erected at East London, South Africa, and which has played an important part in the construction of the harbour works and breakwater. The total weight of this crane is 261 tons. The overall length of the cantilever arm is 119 ft., the height of the top portion of the cantilever arm from the ground being 40 ft. The length of the arm from the centre to the nose—that is the end at which the load is operated—is 78 ft. 9 in., so that the tail—or the portion of the arm on which the engine-house is situated—is 40 ft. 6 in. in length from the centre of the arm. The crane arm revolves on a roller path, which has a diameter of 24 ft., and the arm is capable of being slewed through one complete revolution in three minutes.

This crane is capable of lifting a maximum load of 40 tons and the arm can move this load over an area the maximum radius of which is 65 ft. The total height of lift of the load is 30 ft., and the load may be lowered 58 ft. below the level of the track. The crane is thus capable of lifting a load over a total height of 88 ft. A two-cylinder steam engine is used, the diameter of the cylinders being 11 in. and the stroke 18 in.

The crab runs on four wheels and a lifting rope of $3\frac{3}{4}$ in. circumference is used. The crab has a slow speed of 22 ft. per minute and a quick speed of 45 ft. per minute. Its hoisting speed on slow gear when lifting its maximum load is $8\frac{1}{2}$ ft. per minute, and its speed when racking on low gear with maximum load is 22 ft. per minute. The crane runs on 16 wheels, each of which is borne on springs. The width of the track from centre to centre of the rails is 17 ft.

Apart from the designing, constructing, and the erection on the site of the cranes themselves, there are many other details to which the engineer must give attention. Take, for instance, the question of slinging the huge concrete blocks into position in the breakwater. The least complicated form of hoisting arrangement for slinging concrete blocks is, of course, a simple clip or pair of jaws. There is a large number of designs of these, each being suited for some definite purpose or for some particular conditions of work. Clips of this type depend entirely on friction. In a modified form of the same type of clip—which, however, does not depend upon friction—the lower ends are hook-shaped, the hooks engaging in special recesses moulded in the blocks.

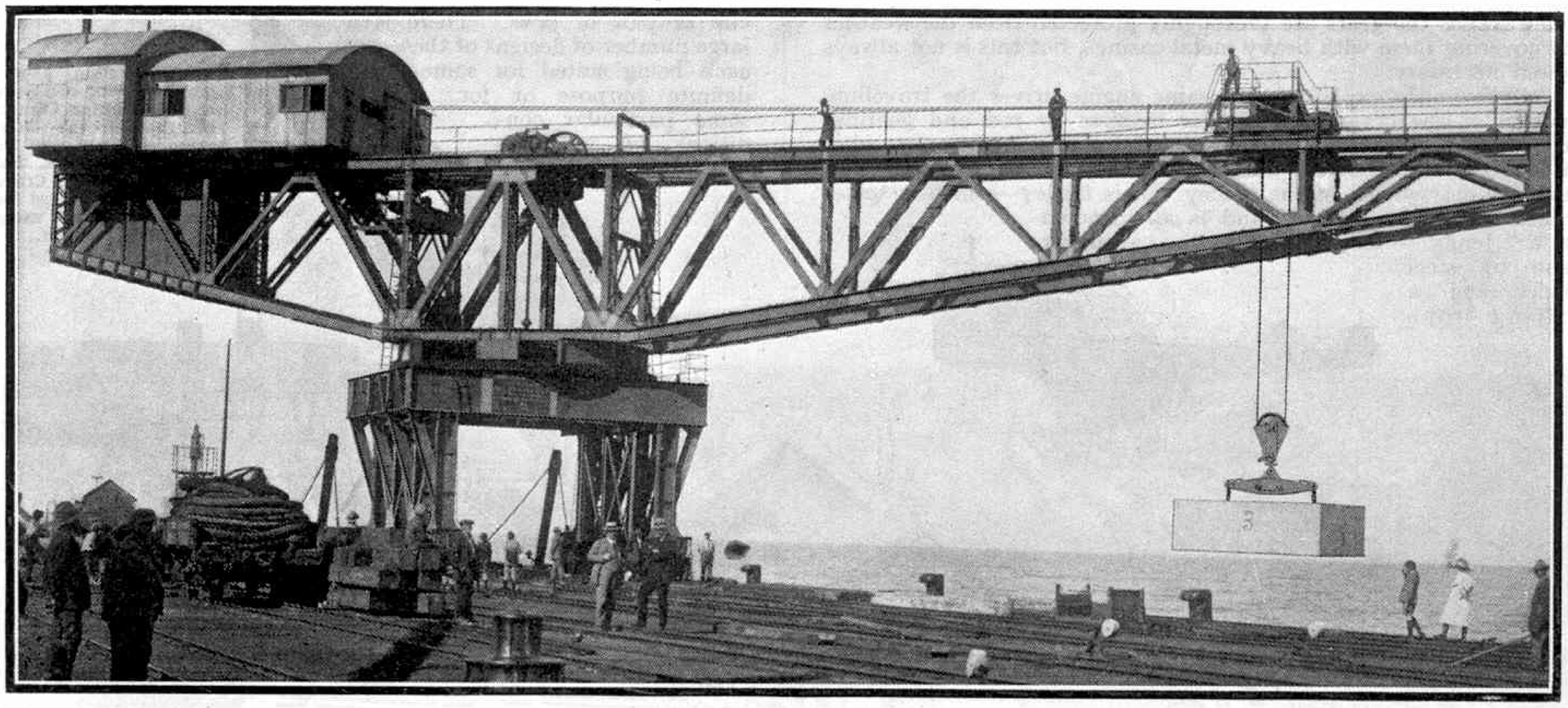
For lifting very large blocks of concrete it is more usual nowadays to use bars passing through vertical holes in which they are retained by various devices. Many of these are self-releasing. These are satisfactory when the blocks are to be set horizontally in a similar manner to that in which bricks are set in building a wall.



A fine Meccano model of the type of Block-setting crane shown on the opposite page.

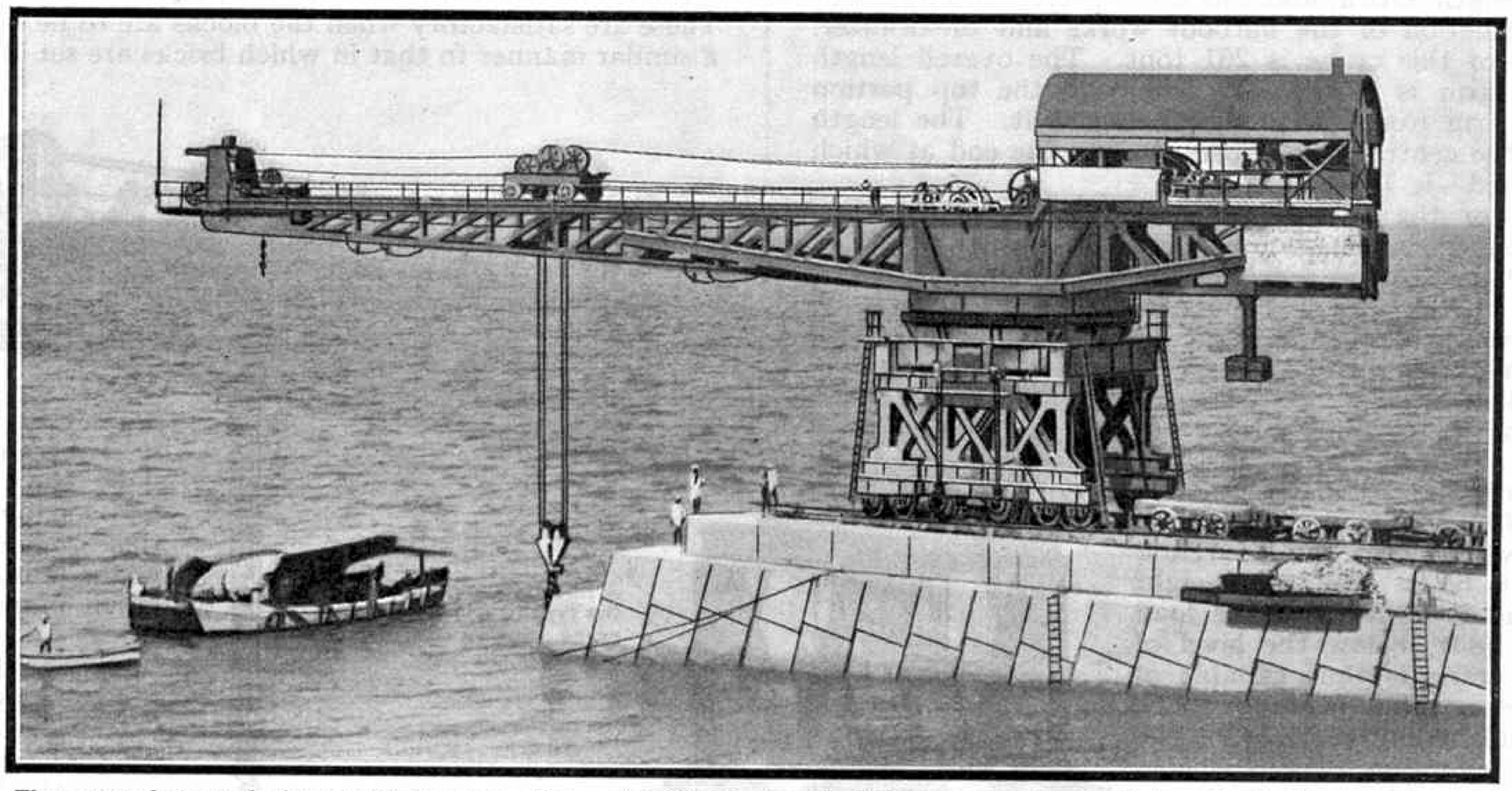
In some breakwaters a more complicated setting is required, however, and the blocks are set at an angle, or, as it is technically termed, "on the inclined bond." By setting the blocks in this manner, the breakwater is made to present a much more formidable obstacle to the rough seas than would be the case if the blocks were set horizontally.

The problem of slinging the blocks for setting on the inclined bond presents some little difficulty, which has been solved by an ingenious piece of tilting mechanism called "Fidler's Gear." This mechanism consists of a massive beam hanging from a swivelling joint, the whole suspended by a special four-sheaved pulley. The rotating movement of the beam on the swivel is controlled by a special worm gear, which meshes with a pinion wheel on the vertical swivel bar. A link hangs from the ends of each arm of the beam, which link supports steel cross-heads. From each of these cross-heads there hangs a long Lewis bar with a T end. Two perpendicular holes run through the concrete blocks. These holes are of sufficient width across one of their sections to take the T-shaped pieces at the end of the Lewis bars.



What happens in actual operation is this. The concrete block is brought on a special truck from the yard where it was made and laid alongside the Titan crane that is to place it in position on the breakwater. The four-sheaved pulley with Fidler's gear is lowered, and workmen guide the T-shaped Lewis bars through the vertical holes in the concrete block. When these completely penetrate the full depth of the block, the bars are given a quarter turn, which throws the T-shaped end out of register with the hole and thus prevents the rods being withdrawn. Shortly before the Lewis bars reach the bottom of the holes, the rollers on the steel-crossheads take a bearing on the top of the block and roll across, altering the relative positions of the points of suspension and the Lewis bars.

The signal is now given to the crane-man to hoist; the engine is started and the block is lifted at the exact angle at which it is to be set in position. The crane hoists the block, swivels round until the block is over its place in the breakwater, and then lowers it as is necessary. When the block rests on the breakwater, workmen turn the T-shaped rods until they are in register with the hole in the block. The crane again hoists and the Lewis bars are easily withdrawn, leaving the block in position set at the correct angle.



The upper photograph shows a 50-ton Titan Block-setting Crane at work at East London, South Africa. In the lower photograph another huge Block-setting crane is engaged in building a breakwater in connection with a harbour extension at Madras.

Cranes of this type have been employed in the construction of some of the best-known harbours of the world, and they have played a very important part in the development of the Empire. Take, for instance, the case of Port Elizabeth, a seaport town some 400 miles east of Capetown. This is the second city in the colony and is situated on Algoa Bay, about seven miles south of the mouth of the Zwartkop River.

The Port owes its prosperity entirely to its harbour and it has become the centre for the trade of a great part of the interior of the country. Previously there were no convenient landing places and so it was impossible for ships to load or unload. Some improvements in this respect were made in 1881 when the old pier 800 ft. in length was constructed. Since that date even more extensive works have been carried out, and the harbour is now one of the finest in South Africa. Port Elizabeth is only one of dozens of similar instances of how giant block-setting cranes help trade.

Looking backward for a moment it is evident that, although progress in engineering has been extremely rapid in all directions in recent times, the development of great seaworks has been one of the most striking features in the history of engineering. As we have already noted, their erection requires great care and thought, as they are subject to continual hammering from the waves throughout the whole term of their existence.

People who only know the sea in its gentler summer moods often find it difficult to realise the destructiveness of the great storm waves. A heavy sea easily moves rocks and boulders weighing many tons. There are many well authenticated instances of this power. For instance, Sir William Matthews, the celebrated engineer, tells us that in 1898 a section of the Peterhead breakwater weighing 3,300 tons was moved bodily by wave action. In 1871 a harbour wall was built at Wick. It was composed of concrete blocks each weighing 100 tons and was capped by two tiers of 80-ton blocks. On top of all was a solid mass of cement weighing 800 tons. The engineers who built this massive structure were thoroughly convinced that it was capable of withstanding all wave action, but to their amazement the sea not only moved the whole mass but actually turned it round and deposited it inside the harbour! As if to show that it could do even more than this, the sea scattered the 80-ton blocks in all directions.

In due course the damage was repaired and the blocks were replaced. This time the engineers, determined to get the upper hand, placed on the top of the concrete blocks a superstructure more than three times as heavy as the original. Once more the sea made light of the work of the engineers, and before this

2,600 ton superstructure had been in position two years it was moved and broken in half.

The construction of works to withstand forces that are capable of creating such havoc would almost seem impossible. Nevertheless such works have been erected and their influence on trade and civilisation has been enormous.

As a maritime nation Great Britain has always been closely concerned in the engineering problems involved in harbour construction. A few hundred years ago neither the Royal Navy nor the mercantile marine was of sufficient importance to require more harbour accommodation than that provided by the natural inlets and sheltered bays found at such places as Portsmouth, Plymouth, Weymouth, Falmouth and Dartmouth. We find, for instance, that in 1540 there were only four vessels of 120 tons burden registered in the Thames. In Queen Elizabeth's time the shipping of Liverpool amounted to only 223 tons, the largest vessel being of only 40 tons. How different are things to-day, when the shipping of the Thames exceeds 47,000,000 tons and that of the Mersey is nearly 26,000,000 tons!

When we turn to the harbour and dock accommodation provided at our great ports we find a similar change. At the beginning of the 19th century London had not a single dock, whereas to-day there are miles and miles of docks. The docks at Cardiff, Newport, Barrow, Middlesbrough and at many other places did not then exist. Even as late as 1816 Liverpool had only 16 acres of dock area, and Hull and Grimsby were no better than fishing ports, as far as their dock accommodation was concerned.

Taking our survey further afield, we find that the breakwater at Table Bay was not commenced until 1860; that until 1875 Calais Harbour had only 2½ ft. of water on its bar at low water; that Colombo Harbour was not commenced until 1870; that Dover was not selected as a site for a great port until 1845; and that the breakwater at Newhaven was not started until 1878. We might extend the list indefinitely, showing that during the past century work in connection with harbour construction at home and abroad has gone forward by leaps and bounds, and has played a greater part than anything else in the development of civilisation in general and the world's trade in particular.

Even the enormous extensions of recent years have scarcely enabled dock engineering to keep pace with shipping, however. The harbour engineer has encouraged the production of larger vessels by providing better dock accommodation and in turn finds that he is called upon for further efforts. At Liverpool, for instance, the magnificent Gladstone Docks were opened in 1927 and are the largest docks in the world. They cover an area of 58 acres and have an entrance lock 1,070 ft. in length. At Southampton, an even larger dock is now in course of construction, and when completed this will be 1,200 ft. in length and 45 ft. in depth. The entrance will be 135 ft. in width.

Thus the process of expansion continues. Larger docks lead to the production of bigger ships and for the safe handling of these still larger docks are demanded. It is quite clear that harbour-building machinery has not yet reached the limit of its development, and in future we may expect to see even larger cranes in use than the Titans and Goliaths of to-day.

Altitude Record—(*Continued from page 939*)

time has been spent in the detail design of this blower in order to ensure reliability and efficiency, and some thousands of hours of development work were carried out on the test bench with different types of fans, driving gear and bearings, before the mechanism was put into the air. Some idea of the efficiency of the supercharger may be gained from the fact that the rated altitude of the standard "Pegasus" engine can be increased by 50 per cent. by detailed alterations to the compression ratio of the cylinders and blower.

The supercharger on the "Pegasus" is housed in a neat casing at the back of the engine, and is driven by a multiplying gear from the crankshaft at the amazing speed of 23,000 revolutions per minute. This means that during the two hours occupied by Flt. Lt. Uwins in making the new record, the supercharger made more than 2,500,000 revolutions. It also means that the tips of the fan blades travel at a speed of 1,000 ft. per second, or nearly 700 m.p.h.! The compression ratio in the blower is 1.8 to 1. The engine must not, of course, be "opened out" fully on the ground when using normal fuel, and safety devices are incorporated to prevent the pilot from opening out or throttling suddenly and so applying enormous loads on the impellor. To give an idea of the efficiency of the supercharger, however, "flat out" tests were made with doped fuel and it was found that the engine actually developed 1,100 h.p. when the airscrew was revolving at normal speed. The supercharger is normally brought into operation when the machine reaches a height of 11,000 ft.

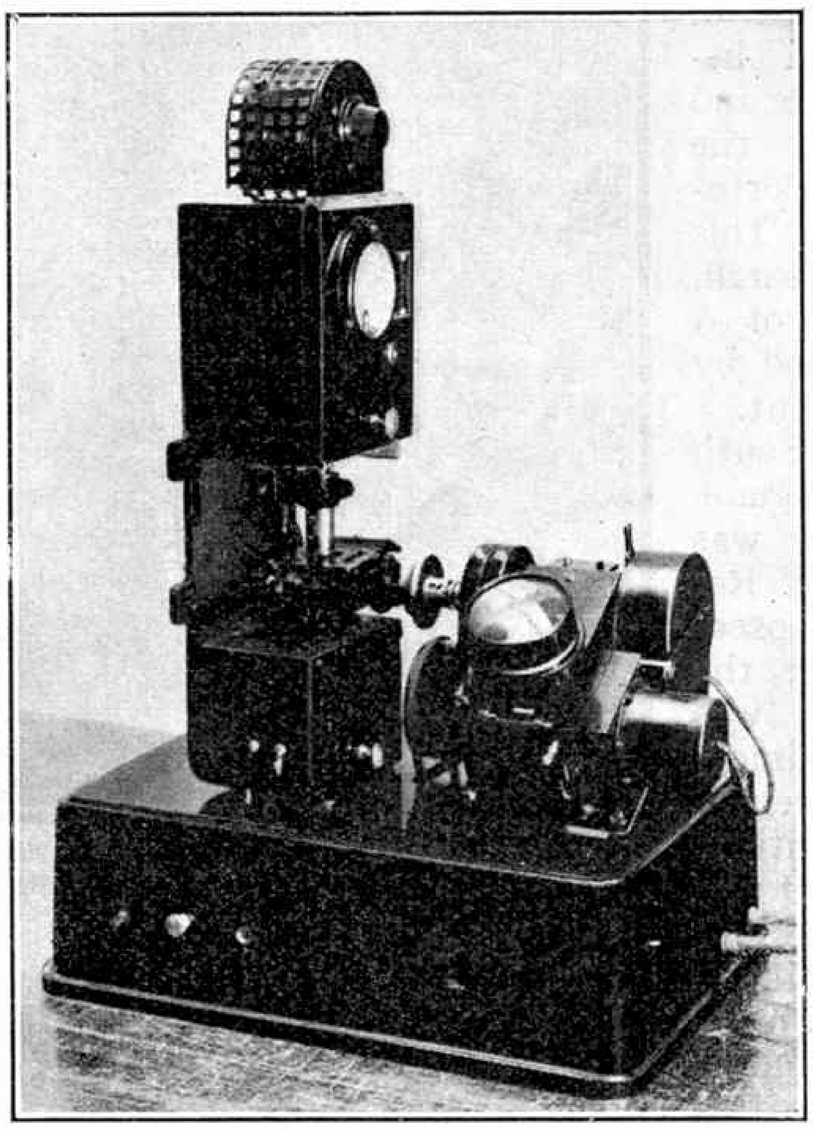
Some idea of the many difficulties that have to be contended with in the construction of a supercharger of this kind may be gained from the fact that air, when compressed, increases in temperature, while any rise in temperature of the ingoing mixture in an internal combustion engine increases considerably its susceptibility to detonation, or, as it is popularly known, "knocking." It is therefore essential that the compressor should be so constructed that it raises the temperature of the air as little as possible. Many intricate problems also have to be met in regard to suitable bearings and their proper lubrication at high speeds.

Meccano helps in the Film Industry

A New Western Electric Editing Machine

FROM time to time reference has been made in the "*M.M.*" to the use made of Meccano by inventors and engineers. There is indeed an accumulating amount of evidence that Meccano is superseding to a great extent the older methods of model-making. Formerly an inventor who wished to try out in miniature form a new idea must either make for himself the various parts required, or have them specially made for him. In the first case the process was slow and laborious, and seldom satisfactory unless the inventor had considerable skill in such work; in the second case there was the serious drawback of the expense involved. Even when the first set of parts was complete the trouble was not over, however, for almost invariably changes in the design of the model were made, usually involving the preparation of additional parts. Finally there was the possibility that the idea might in the end turn out to be impracticable, so that the time and money spent in constructing the model were wasted.

The new method of model-building for inventors is to employ the interchangeable Meccano parts, which constitute real engineering in miniature and enable practically any mechanical movement to be reproduced perfectly. The making of special parts thus becomes unnecessary, and when the model has served its purpose and is taken to pieces, the component parts are all available for inclusion in a new model.



The new Western Electric film editing machine developed by means of a Meccano model. Photograph by courtesy of the Western Electric Co. Ltd.

One of the most recent applications of Meccano to invention is in connection with the development of a new type of "editing machine" by Mr. H. C. G. Allen of the technical staff of the Western Electric Co. Ltd. Mr. Allen made his first model almost entirely from Meccano parts, the adaptability of which enabled him to solve a series of quite formidable mechanical problems.

Editing machines are used in the film industry for the purpose of viewing rush prints as they are received from the printing laboratories, so that any defects may be instantly detected and removed, or unwanted scenes cut out. It might be wondered why this viewing should not be done by means of an ordinary theatre reproducer. This would involve the use of a theatre, however, and probably only one film at a time could be viewed. The process of editing would thus be considerably slowed up, and time means money to a film laboratory. The new machine, in the construction of which Meccano played so important a part, is shown in the accompanying illustration. As many as a dozen of these machines may be operated in one room, so that as many films may be cut and edited at the same time.

The machine is operated entirely from the mains. It will run either double or single film, that is sound and scene combines on one film, or on separate film. This is an exclusive feature of the machine that makes it extremely valuable for newsreel work, where picture and sound are recorded simultaneously on one film. There is no intermittent action at the picture gate, the film passing through both this position and the sound gate at a smooth and constant speed. The value of this feature lies in the fact that it permits almost completely silent operation, there being no "flap" from the film, an action that always takes place where the intermittent movement is evident.

A "stationary" picture is obtained by means of flashes from a neon or television tube situated immediately beneath the viewing head. These flashes are so timed that they occur at the exact moment when a frame is passing the view-finder. The timing is accomplished through a circuit-breaker mounted on the picture sprocket, and the arrangement consists of a commutator with one narrow segment for each frame, so that as each frame reaches the picture gate a momentary contact is made and the neon lamp flashes. The flash is so quick that the picture appears absolutely stationary, and without the "ghosts" that are usually present in a simple intermittent motion used without a shutter.

A simple amplifier is housed in a drawer directly underneath the sound head. The circuit is so efficient that sufficient volume is obtained from a single stage of amplification to operate a loud-speaker. Alternatively headphones may be used, according to the special requirements of the operator.

Notable features of this interesting machine are its compactness and its simplicity of operation. In addition it possesses the high efficiency and complete reliability that are essential in a mechanism of this nature.

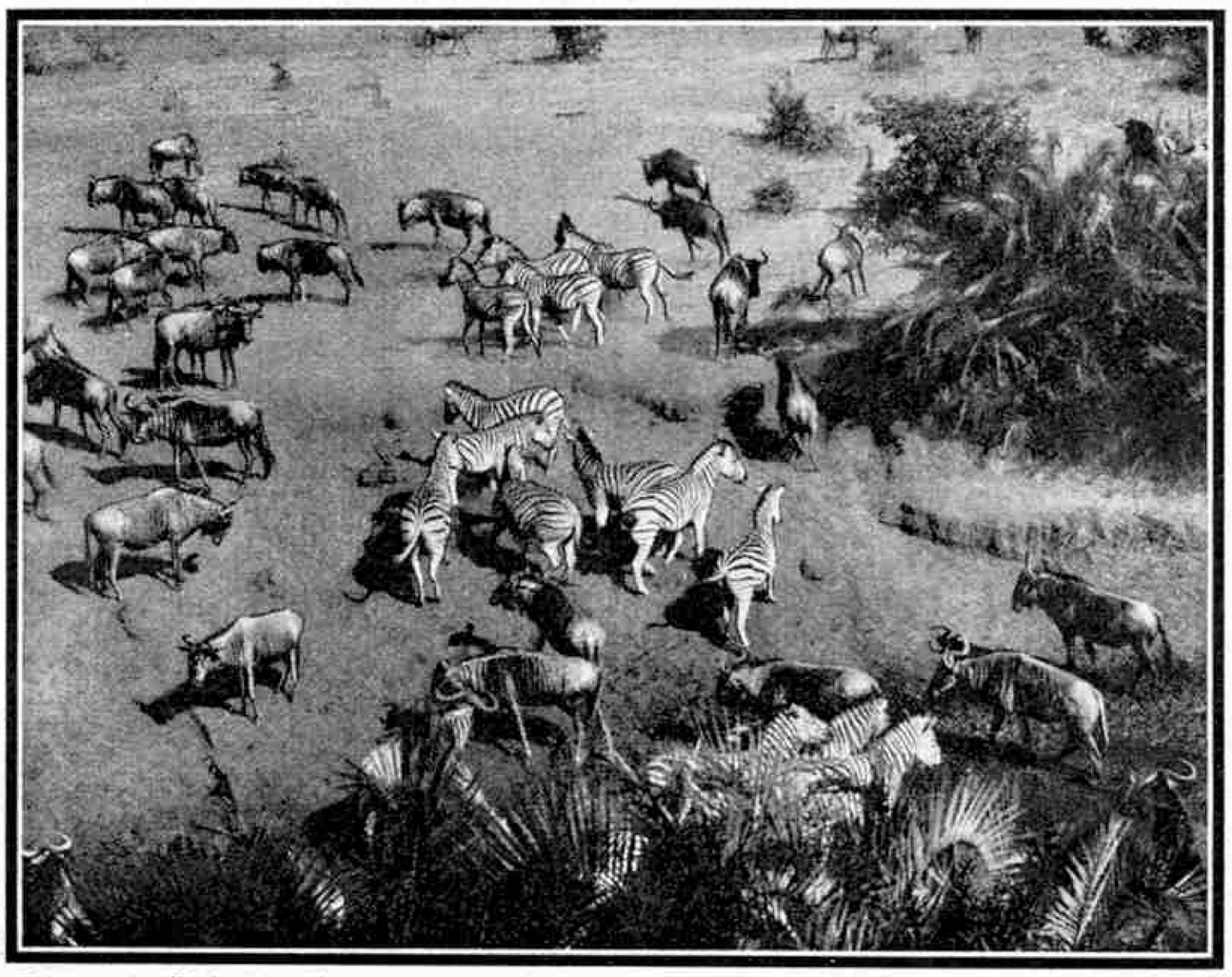
A Great South African Game Reserve

The Kruger National Park

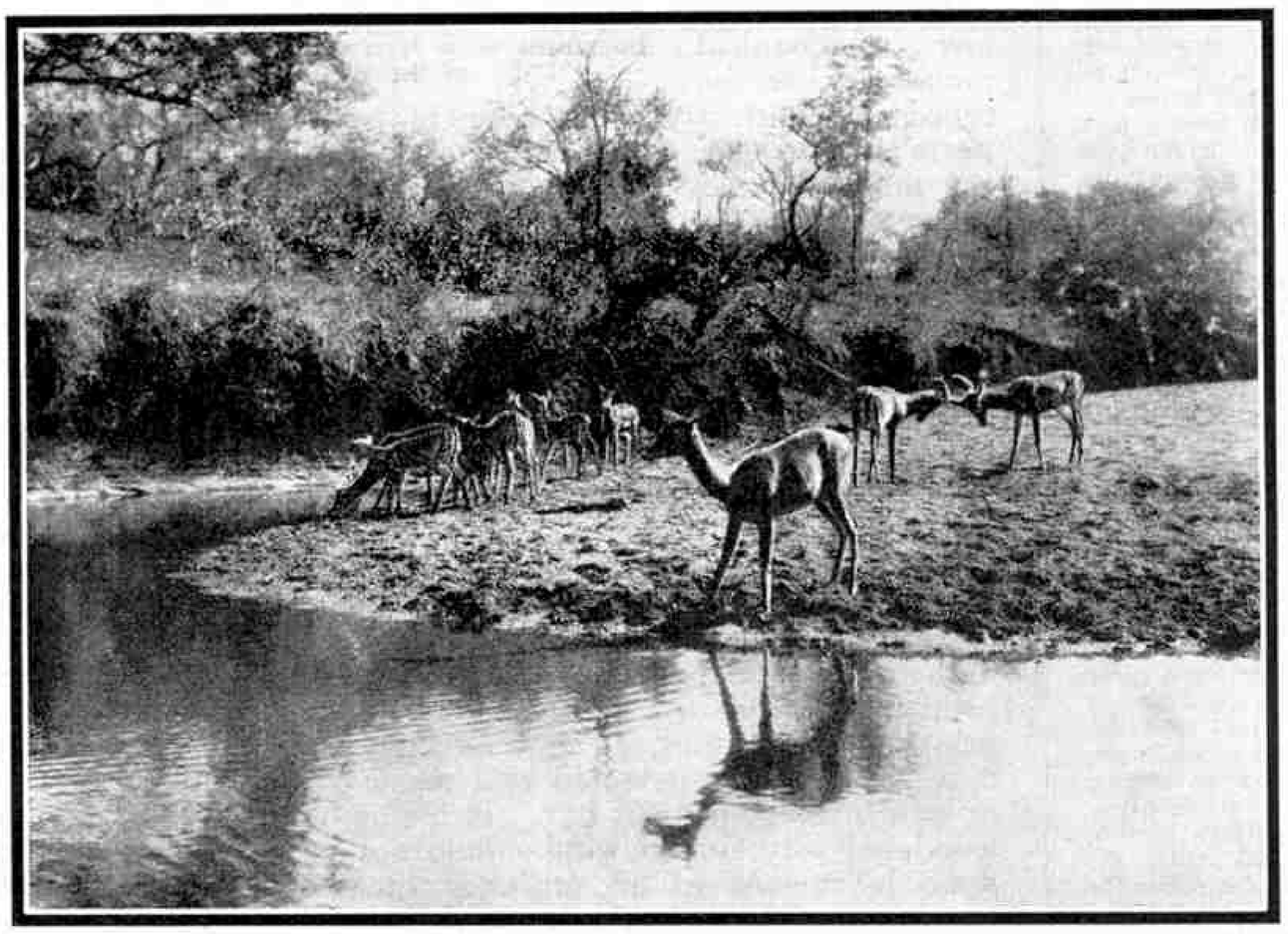
A FEW years before the South African War strong representations were made to President Kruger that the various species of animal life of South Africa were rapidly becoming extinct, and that it was urgently necessary to adopt immediately stringent measures for their preservation. One of the results of these representations was the setting apart as a sanctuary for game the area of Government land between the Crocodile and Sabi rivers near the boundaries of Portuguese East Africa. This was done on 26th March, 1898, by means of a proclamation issued by the State President.

During the South African War this game reserve, which was known as the Sabi Reserve, naturally lapsed. Immediately after the war, however, it was once again proclaimed, and in 1903 it received important additions designed to protect certain species that were not included in the old reserve, and at the same time to allow of wider migratory space for the herds. A Warden and rangers were appointed, together with an adequate staff of native assistants to ensure that the law was carried out. When all the additions were complete, the game reserve stretched from the Crocodile River in the south, all along the Portuguese boundaries to the Limpopo and the Rhodesian border in the north, and from the Portuguese boundary in the east nearly to the foothills of the Drakensberg in the west. In all, the reserve included an area of some 200 miles by 60 miles.

For a good many years after its creation the game reserve had to be administered with the single purpose of renovating the various species of animals native to the district, some of which, notably the black and white rhinoceros, the elephant and the eland, had entirely or practically disappeared. In addition there were others, such as the buffalo, the giraffe, the kudu, and the roan antelope, that were within measurable distance of total extermination. About the time of the Union of South Africa the various species had secured for themselves a good footing, and some of the vanished ones, such as the elephant and the eland, had begun to trickle back from neighbouring Portuguese territory. It then began to be felt that some ideal beyond that of merely preserving species for scientific and sentimental ends was desirable. It was realised that the public, who had been paying to the extent of some £4,000 or £5,000 a year for the preservation of the animals, had a right to see something as the result of their money. The whole situation needed to be stabilised, and there was the complication that the reserve contained a good deal of private land. Clearly the only way to secure the future of the animals for the benefit of the public was by the establishment of a great national park under the Union Government. This came about in 1926, when the Union Government succeeded in placing on the Statute Book a law calling into existence the Kruger National Park, where the wonderful animal life of the country should find sanctuary for all time.



Zebra and wildebeeste drinking in the Kruger National Park. For the illustrations to this article we are indebted to the courtesy of the South African Railways.



A group of impala in the National Park. The two animals in the background on the right seem to be having a friendly argument.

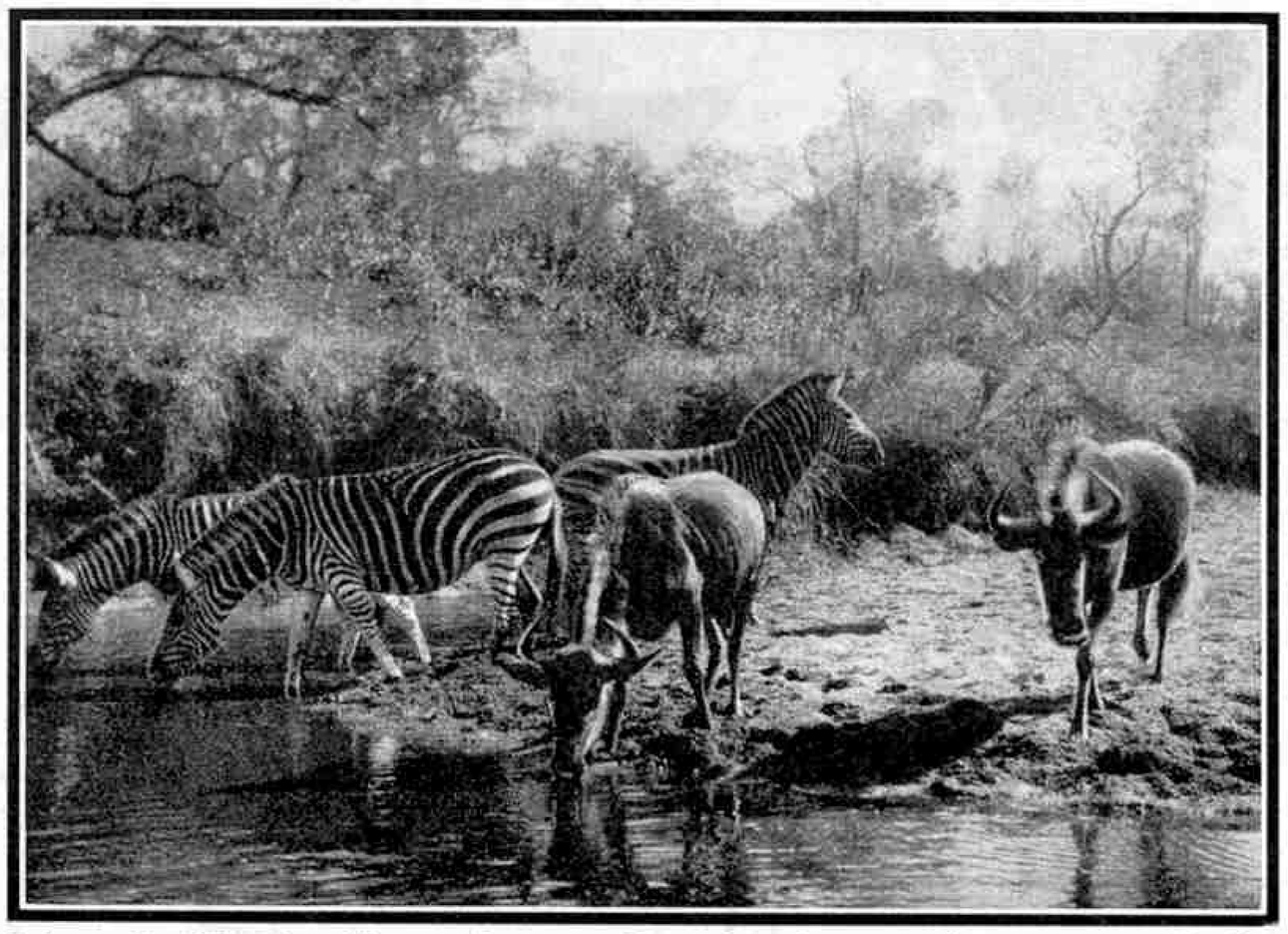
The Kruger National Park is a romantic land of forest and kopje; of reed-fringed rivers and wide boulder-trimmed gorges; of untutored natives; of elephants, giraffes, antelopes, lions,

and indeed all the fast-vanishing things that a century ago made up South Africa. It stretches along the border of Portuguese East Africa from Komatipoort in the south to the point in the north where the territories of the Union, of Rhodesia, and Portuguese East Africa meet in the Limpopo River. The distance from north to south is about 220 miles, and from east to west it averages about 40 miles.

If it were financially possible to provide facilities for tourists to view the reserve generally, such as motor roads, resthouses, and an adequate staff of guides, there can be little doubt that an extremely popular and entirely novel holiday resort would be opened to the people of the Union during the months between May and October. In addition to the unique display of animal life, there are many strikingly beautiful and wild pieces of scenery, and there is a great field for the botanist and lover of Nature generally in the native forest trees. flowers and grasses which, like the animals, remain as they have existed from time immemorial. The few resident natives live still to a great extent under tribal law, and are unspoiled by contact with civilisation. The caves, which appear in nearly all the rock outcrops, are of interest, and might offer results to the archæologist; while the Bushman paintings, which appear in good condition in many of the caves in the Logogote area south of the Sabi, are certain to provide an attraction. An interesting landmark is the ruin of the house of Albassini, situated on the south bank of the Sabi River, and representing, so far as is known, the abode of the first white man to enter and reside in the eastern low veldt.

The rocky steeps of the Lebombo hills, as well as the many isolated hills and kopjes that stud the interior, afford opportunities to those whose energies impel them to mountain climbing, and from the summits wonderful panoramas of the bush-clad plains and of their wild inhabitants may be obtained. Some of the gorges by which the various rivers cut their way through the Lebombos are extremely impressive. As may be imagined, a great field for both still and moving pictures is afforded by the very tame animal life of the reserve. The art and skill required to stalk and photograph wild animals successfully completely surpasses anything that the rifle can offer, while the results are more satisfactory and more enduring.

A short survey of the principal animals that make their home in the reserve will be of interest. There are now two main herds of elephants permanently located in the reserve, and in addition a good many other elephants alarmed by shooting taking place on Portuguese territory, have migrated into the reserve at various points. A few specimens of the black rhinoceros exist. This creature is fast disappearing from even the best game countries of Africa to-day, and exceptional efforts are required to preserve it from extinction. Fortunately it has no natural enemies. Giraffe are increasing and are spread over a considerable portion of the reserve. Zebra, after wildebeeste and waterbuck, are the most numerous large species in the reserve. They are highly decorative and tame, and have always been greatly admired by visitors, indeed, probably no other animal adds more to the attractions of a tour through the reserve.



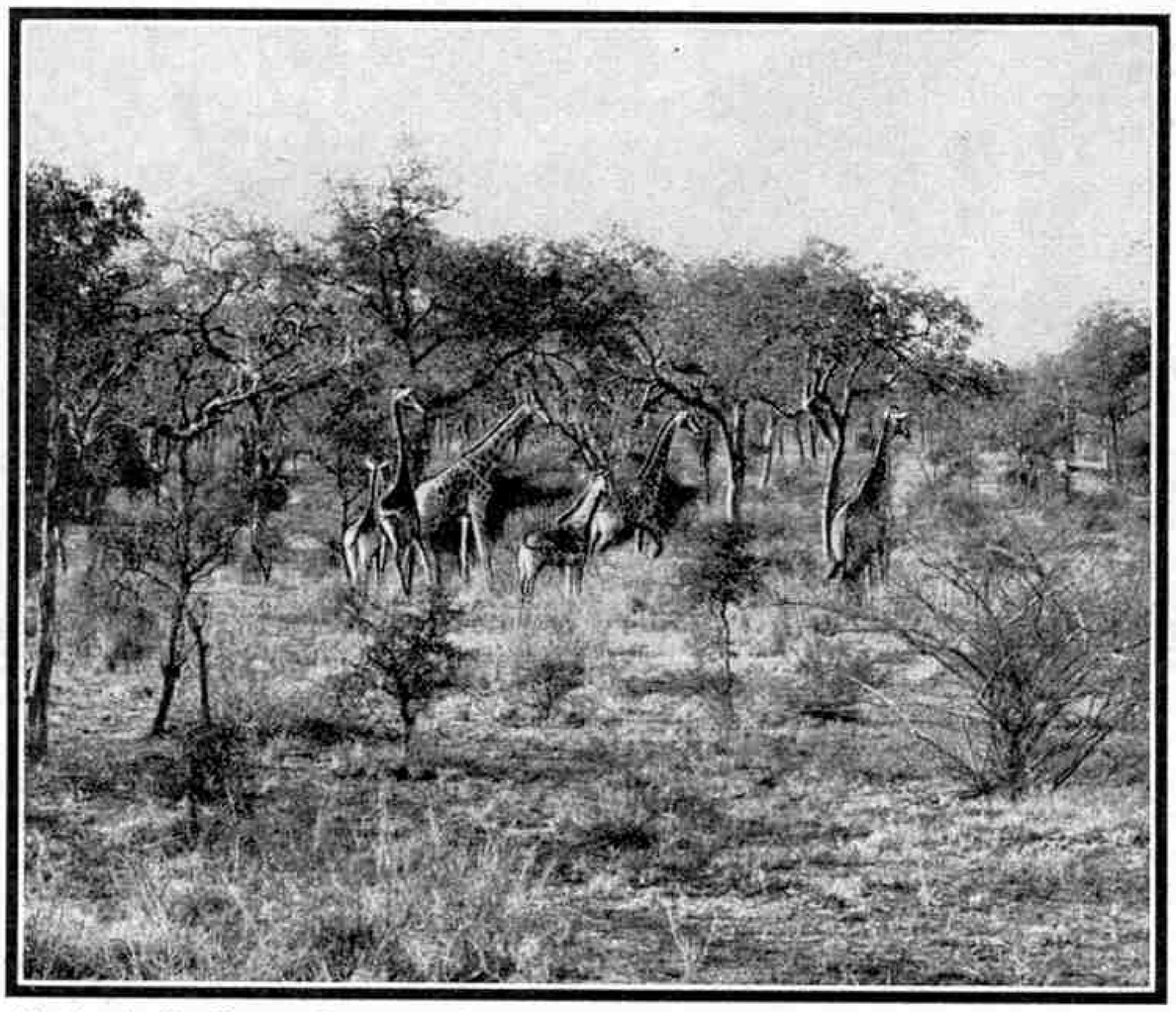
Zebra and wildebeeste. **The conspicuous markings of the former are in strong contrast to the subdued colouring of the wildebeeste.**

Hippopotamus exist in all the larger rivers, but they do not increase much in numbers, and in some places appear actually to have decreased. Owing to their habit of life they cannot be fully protected in rivers that form boundaries of the reserve. Buffalo were believed in 1902 to consist of little more than a dozen individuals. Since that time they have increased considerably, and are now well spread over much of the area in the central parts of the reserve.

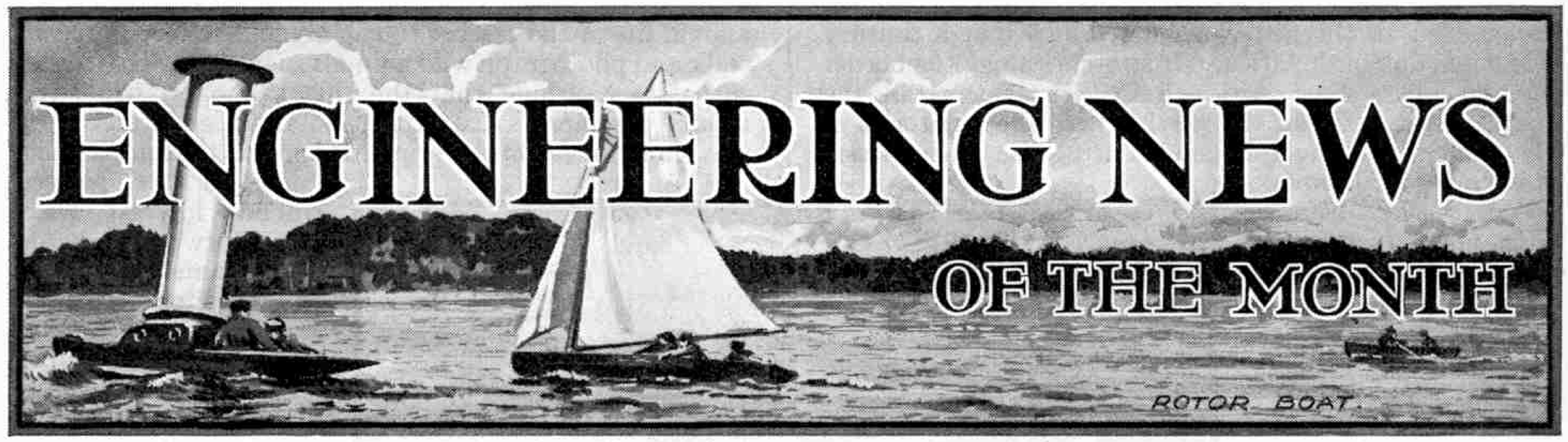
The blue wildebeeste is the most numerous species at present found in the reserve. It appears to feed on a larger variety of grasses than most other species, and has no natural enemy except the lion. The extreme tameness of these animals, coupled with their large numbers and quaint appearance and manners, always form a great attraction for the ordinary visitor, who is enabled to look at them from close quarters with little more effort than is required to view animals in a zoological garden.

The natural function of carnivorous animals is to prey upon the herbivorous species,

(Continued on page 935)



Giraffes in the Kruger Park. **The enormous height of these animals is well shown in relation to the trees.**



New Italian Liners

Two new Italian liners recently have carried out their maiden trips. These are the "*Rex*" and the "*Conte di Savoia.*" Both of these vessels are expected to be capable of travelling at speeds in excess of 28 knots, and therefore there seems little doubt that one of them will quickly obtain the Blue Riband of the Atlantic.

Of the two new liners, the "*Rex,*" with a gross tonnage of 51,075 is somewhat the larger, the gross tonnage of the "*Conte di Savoia*" being only 48,000. Both vessels have been constructed for the Italia-Flotte Reunite Line, a combination of a number of Italian shipowners. The vessels are employed on the service between Genoa and New York, a journey that usually occupies 10 days. The new vessels are capable of completing it in 6½ days. The "*Conte di Savoia,*" is 811 ft. 9 in. in overall length, its length at the water line being 744 ft. 6 in. She has a breadth of 95 ft. 10 in. and a draught of 30 ft. 6 in. An interesting feature of this vessel is the quickness with which she has been constructed. The keel was not laid until the beginning of October 1930 and the ship was launched at the end of October 1931. This is two months less than the time taken to construct the "*Bremen.*"

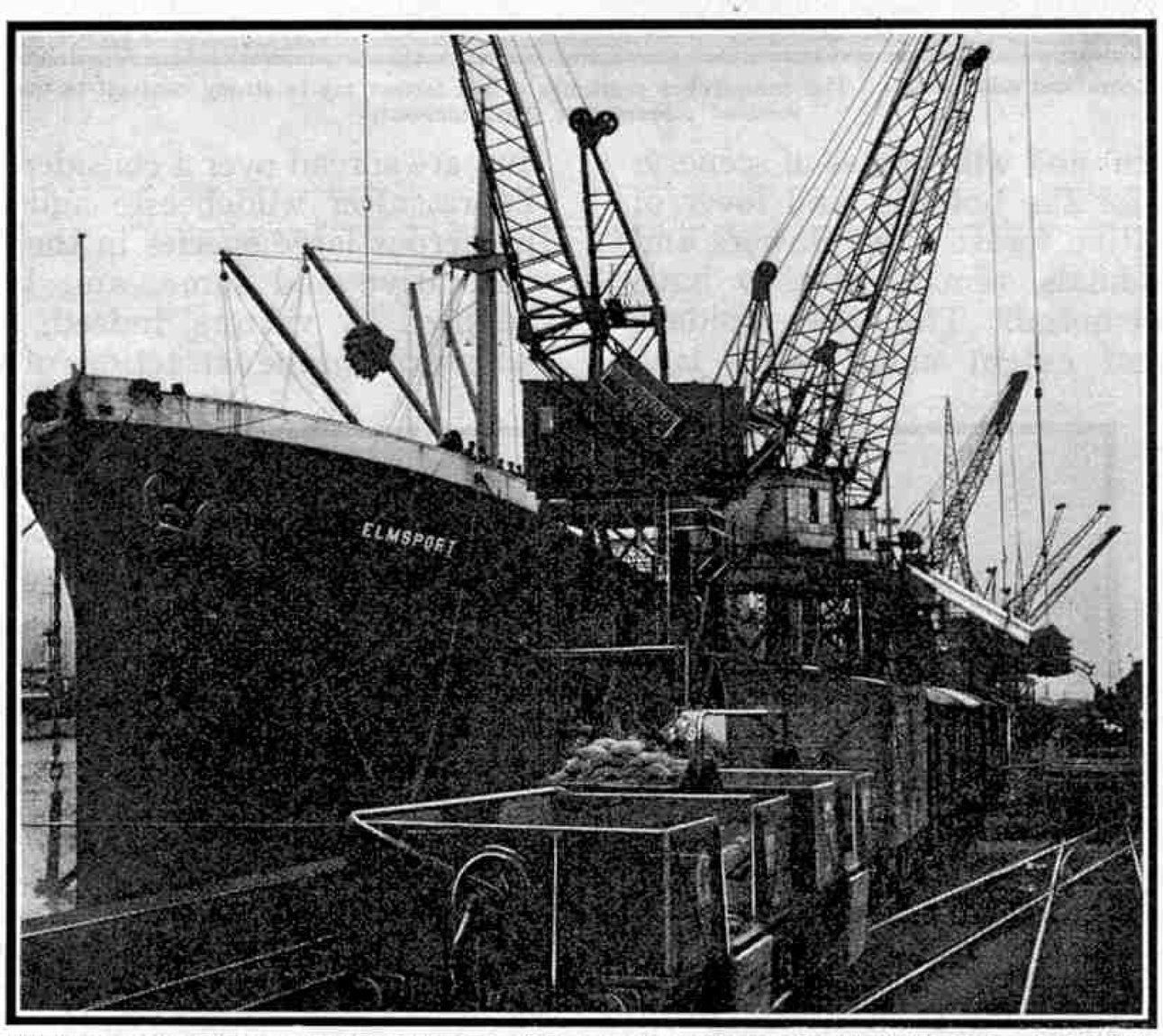
The vessel is driven by four screws, each of which weigh 18 tons and is 16 ft. in diameter, the total power developed being 120,000 h.p. The vessel is fitted with 10 water tube boilers and an additional three high pressure boilers for auxiliary work. Oil firing only is used, the ship being provided with tanks to carry 7,000 tons of oil.

The "*Rex*" is 880 ft. long and has a beam of 102 ft., and is the largest ship ever built in an Italian shipyard. Her propelling machinery consists of H.P., I.P., and L.P. turbines, each unit of which is coupled through 10 : 1 single-reduction gearing to the propellers. The turbines have a normal output of about 100,000 s.h.p., but this figure was exceeded by 20,000 h.p. during her full power trials, when she attained a speed of over 28 knots. The normal service speed of this huge vessel is 27 knots.

Huge Omnibus Garage

What is claimed to be the largest garage of its kind in Europe was completed recently for the Corporation of Glasgow to house their buses. The garage has taken a year and five months to erect and has cost £75,000. It covers an area of 76,000 sq. ft., and can accommodate about 200 double-deck buses.

The equipment of the garage includes overhaul and inspection pits, engineers' repair shop, electricians' shop, battery charging shop, paint shop, general and tyre stores, cleaners' rooms and a boiler house. Two high-tension electrode boilers connected to four storage tanks, and one hot water service calorifier, are used for heating the garage, and small pumps keep the water in circulation between the boilers and the storage tanks. The equipment for washing the buses includes four electrically-driven pumps that increase the pressure of the water to 300 lb. per sq. in. Two 40 in. exhaust fans, one at each end of the building, are connected to a system of floor ducts, and through these draw the exhaust gases out of the building. The petrol supply for the buses is stored in four large tanks each of 5,000 gals. capacity, and electrically-driven pumps draw the petrol through valves and piping as required.



Electrically operated level luffing cranes loading general cargo at a South Wales port. See article "Level Luffing Cranes and their work" on page 922 of this issue.

Galloway Hydro-Electric Scheme

The first stage of the 100,000 kw. Galloway hydro-electric power scheme is now in hand. This part of the work includes the construction of two power stations at Tongland and Glenlee, designed for outputs of 33,000 kw. and 24,000 kw. respectively; and three reservoirs in the valley of the Rivers Ken and Dee. Water for the Tongland station will come from Loch Ken by way of the River Dee, and will be controlled by a barrage at Glenlochar, three miles from Castle Douglas. At this point the river is about 300 ft. wide, and the barrage has six outlets, each 45 ft. wide and closed by a steel sluice gate. The gates can be operated electrically or by hand. Glenlee power station will be served by a 1,000-acre reservoir at Clatteringshaws.

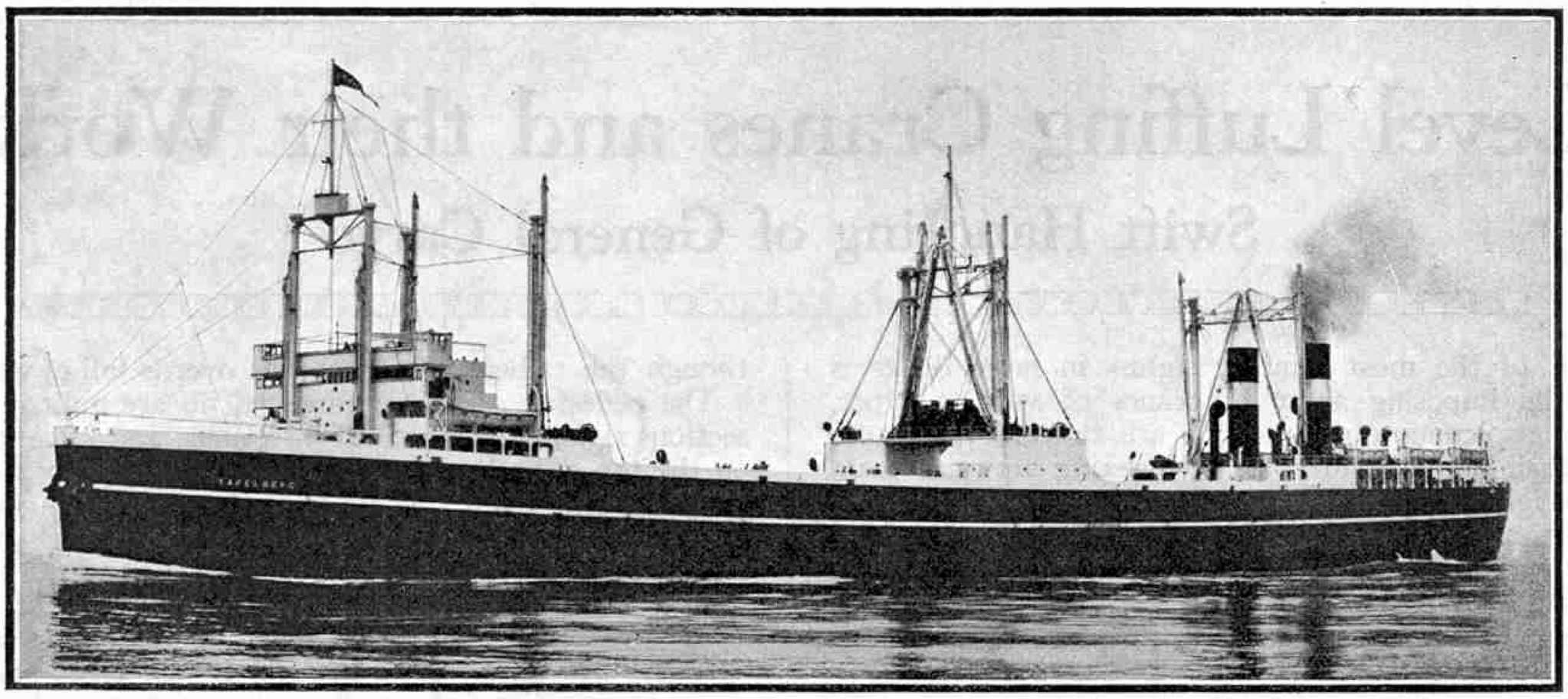
The second part of the scheme will consist of building and equipping three power stations in series, higher up the River Ken. When the whole scheme is completed it will form one of the largest hydro-electric plants in Great Britain.

Canadian Hydro-Electric Scheme

An important hydro-electric scheme is now in hand at Beauharnois, Canada. A canal 15 miles long is being constructed that will enable ships to avoid a series of four rapids in the River St. Lawrence, and when completed it will be used also as a source of hydro-electric power.

The canal leads off from Lake St. Francis, and as it follows a route that is below the level of the lake, most of the work involved has been the construction of high embankments. These banks vary in height from 10 ft. to 24 ft. and are faced with stone to prevent erosion. The canal is 3,300 ft. wide and has its outlet near Beauharnois, passing through a power house there into the River St. Lawrence. The power house is designed to deal with a water supply giving 500,000 h.p., but at present plant capable of developing only 216,000 h.p. has been installed. This plant consists of four 50,000 h.p. vertical turbo-alternator sets and two 8,000 h.p. sets.

We hope to deal fully with this interesting scheme in a future issue of the "*M.M.*"



The floating whaling factory "Tafelberg" described in "The Romance of Whaling" on page 924 of this issue. In outline the ship suggests a blend of an oil tanker and a train ferry steamer. She is 520 ft. long, and 172 ft. broad, and was built by Sir W. G. Armstrong Whitworth & Co. Ltd., to whom we are indebted for this photograph.

New Cantilever Crane on the Clyde

A large electric cantilever crane with a lifting capacity of 175 tons at 85 ft. radius has been erected at Stobcross Quay, on the Clyde, to facilitate the fitting out of new ships. The main cantilever is 30 ft. deep at the centre, and has an overall length of 253½ ft., and the hoist has a clear lift of approximately 170 ft.

The crane stands on foundations consisting of steel caissons sunk to a depth of 50 ft. below the quay level. The roller path upon which the main cantilever slews is carried on the top of the main tower, the legs of which are 45 ft. apart. Slewing is effected, through worm and spur gearing, from a series-wound motor of 50 b.h.p. at 400 r.p.m. A second series-wound motor, of 165 b.h.p., operates the main lift. Electrical energy for working the crane is obtained at 6,500 v. from Glasgow Corporation.

Giant French Liner

The new giant French liner, at present known as the "*T.6*," was successfully launched at St. Nazaire on 29th October last. This ship is to be named the "*Normandie*," and represents France's bid for the Blue Riband of the Atlantic. She has an overall length of 1,027 ft., a beam of 119 ft. 6 in. at the corbelled promenade deck, and a depth at this deck of 91 ft. 4 in.

This huge vessel has eleven decks, and five of these extend the full length of the vessel. The hull is divided into twelve watertight compartments, and the space provided by the double bottom will contain fuel and fresh water tanks. She will be propelled by turbo-electric machinery that has been designed to give her a service speed of 30 knots. Four turbines, having a total of 160,000 h.p. will drive 5,000 volt alternators that in turn will supply current to four propulsion motors. It is expected that she will make the Atlantic crossing from Le Havre to New York via Plymouth in less than five days, irrespective of weather conditions.

The "*Normandie*" will carry 930 first class, 680 tourist and 560 second class passengers, in addition to a crew totalling 1,320 officers and men.

Oil Engines for Basra

Five oil engines are to be built for a new power station at Basra, on the Persian Gulf. Two of these will be of the eight-cylinder type and will drive a 250 k.w. alternator. The remaining three will be four-cylinder engines. Two of them will drive 125 k.w. alternators and the fifth engine will be coupled to an alternator capable of developing 65 k.w.

* * * *

At Liverpool, recently, the 20,000 ton Canadain Pacific liner "*Duchess of Bedford*" was docked at 2.59 p.m. for an examination of her hull below the waterline, and the dock was drained, the examination completed and the ship refloated by 8.35 p.m. the same day.

A post office employee at work in an apparently precarious position, on an overhead cable. This illustration is reproduced by courtesy of the General Post Office, London.

Wireless Beacon Stations in China

The Marconi automatic wireless beacon station installed two years ago at North Saddle Island, near Shanghai, has proved so successful that similar beacons are to be erected at two other important points. They will have a power of 700 watts and 500 watts respectively.

These automatic beacons are each controlled by a master clock that switches on the transmitting apparatus at set times, and after this has sent out the signal of the beacon the apparatus shuts down until the time comes for the signal to be repeated. The interval between the signals can be regulated so that frequent calls can be sent out in foggy weather, and a smaller number in fair weather.

New Landing Jetty for Port of Bordeaux

Important work being carried out at the Port of Bordeaux includes the construction of a new passenger landing jetty at the outport of Le Verdon to meet the needs of the South American services. Le Verdon is about 62 miles from Bordeaux, and by landing there passengers will be able to travel to Bordeaux by express, and thus avoid the delay involved by the long river trip.

The project was first considered as long ago as 1910, and an Act of Parliament obtained for port extension work at Le Verdon, but the intervention of the War caused the scheme to be set aside, and subsequent financial difficulties have delayed the work until now.

Large Canadian Oil Refinery

A large new oil refinery that is believed to be the largest yet built in Canada is being erected at Montreal for the Shell Oil Company of Canada. The installation includes five storage tanks with a total capacity of 4,130,000 gallons, and it will have a capacity of 100,000 gallons of petrol a day.

* * * *

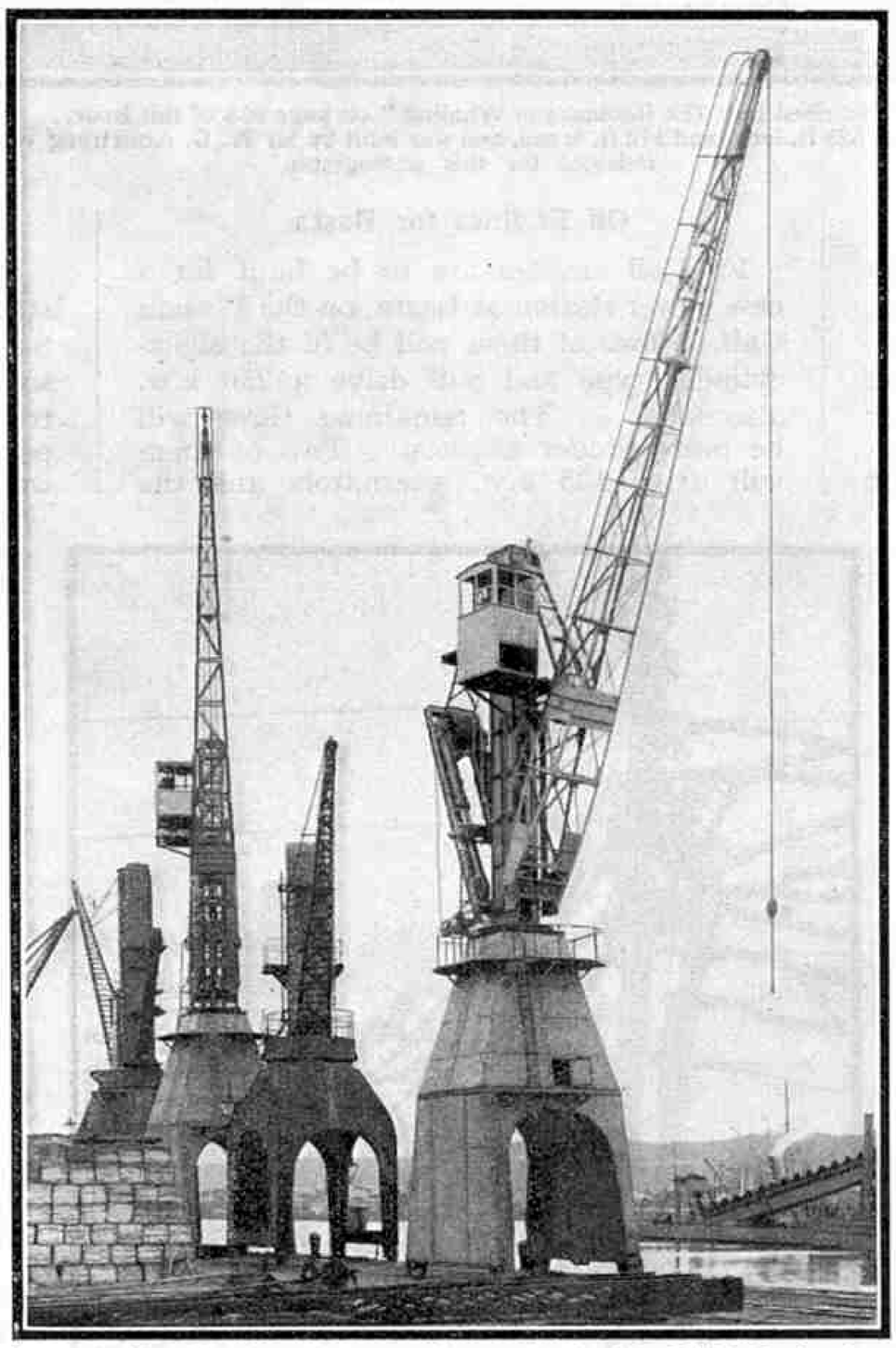
The P. & O. liner, "*Viceroy of India*," recently made a new record when she travelled between London and Bombay in 16 days, 1 hr., 42 mins. The average speed was 17.92 knots. The previous record was beaten by 1 day 19 hrs.

Level Luffing Cranes and their Work

Swift Handling of General Cargo

ONE of the most familiar sights in large docks is the imposing array of cranes of various types, conspicuous among which are the tall jib cranes with their long slender arms towering upward to a great height. These cranes are an essential and interesting part of dock equipment and are used for shipping and unloading a variety of merchandise classed as general cargo, and also for dealing with cargoes of timber and wood pulp. A row of these cranes in operation presents a fascinating spectacle as the jibs, like long arms, alternately reach out over a ship's hold and then swing back swiftly over the quay.

There are many different types of jib cranes, but their general principle is that of a fixed or movable base on which is mounted a turntable supporting at one side the long overhanging jib that carries the load, and at the other side a platform or other provision for a counterbalancing weight. The majority of jib cranes are of what is known as the level luffing type, in which the load lifted by the crane is kept at a uniform height while it is being transferred from ship to shore, or vice versa. In one type of level luffing crane the load is kept level by running the crane chain round a system of pulleys in such a manner as to form a gear that automatically compensates for the upward or downward movement of the jib. In another type the compensating gear consists of a small hinged jib at the upper extremity of the main jib, which moves in conjunction with the luffing movement of the latter. It is claimed that by this means the load can be moved in a horizontal direction considerably quicker than with a crane lacking the level luffing apparatus, and with an expenditure of only one-twentieth of the energy.



A group of level luffing cranes at the Preston Dock of the Ribble Navigation. The cranes were built by Vickers-Armstrong Limited.

The level luffing cranes on the quays of large docks are usually mobile machines, the revolving superstructure being mounted on a massive braced pedestal that runs on two rails, one of which is placed close to the edge of the quay. The crane track is of broader gauge than the track traversed by the dock trains, and the portals in the sides of the crane pedestal extend well above the standard railway loading gauge. Trains and wagons shunted along the quay can therefore pass safely beneath the crane whether this is in operation or not; and similarly the crane can move along the quay even though the railway line it stands over is full of wagons.

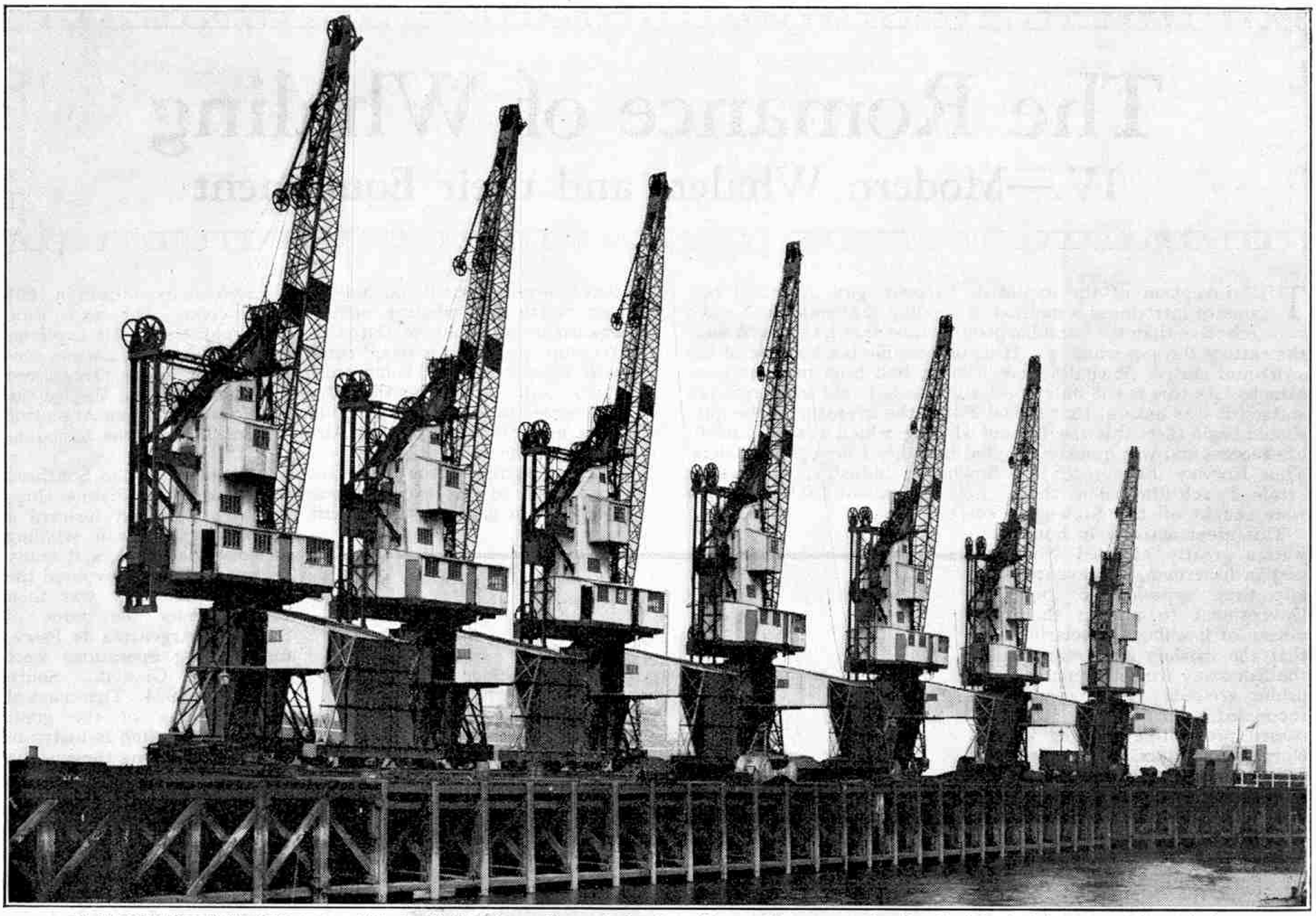
The pedestal, superstructure and jib are built of steel sections rigidly braced in all directions, and huge girders on the top of the pedestal carry the roller path, slewing ring and centre pin. At its base the pedestal is secured to massive wheeled carriages built up of steel girders and provided at each end with screw jacks and rail clips.

The lifting capacity of dock-side level luffing cranes varies from one to ten tons, and the radius of operation varies with the load. The cranes have four separate motions, hoisting, luffing, slewing and travelling, all of which are controlled from the driver's cabin on the revolving superstructure. This cabin is placed sufficiently to one side to give the driver an unobstructed view of the load in all positions. In some cranes the cabin is situated at the base of the jib, and in others it is mounted on top of a pillar, from which elevated position the driver is able to look down on the moving jib as it responds to his manipulation of the controlling levers. The cabin is generally a wooden structure with doors and windows, covered inside and outside with sheets of asbestos composition or other non-inflammable material, and with a floor of steel plating.

The hoisting and luffing barrels and other mechanism, and in the case of electrically operated cranes also the motors, for effecting the different motions of the crane, are situated in the machinery compartment at the base of the jib. In some cranes the motor for the travelling mechanism is placed in the upper part of the pedestal, the motion being transmitted through gearing and shafts to the track wheels.

The weight of the crane jib is perfectly balanced at any radius, and its raising and lowering is performed either by means of ropes from the jib head or by crank mechanism. The latter method has the advantage that no ropes are required for luffing or balancing the jib, the luffing motion being effected by cranks and connecting rods, and the jib being balanced by weights attached to the bottom end.

Hydraulically operated level luffing cranes are in use at many docks, and one of the accompanying illustrations shows a group of 30 cwt. cranes of this type at the Preston Dock of the Ribble Navigation. The cranes are of the Mitchell-Williams level luffing type and have a

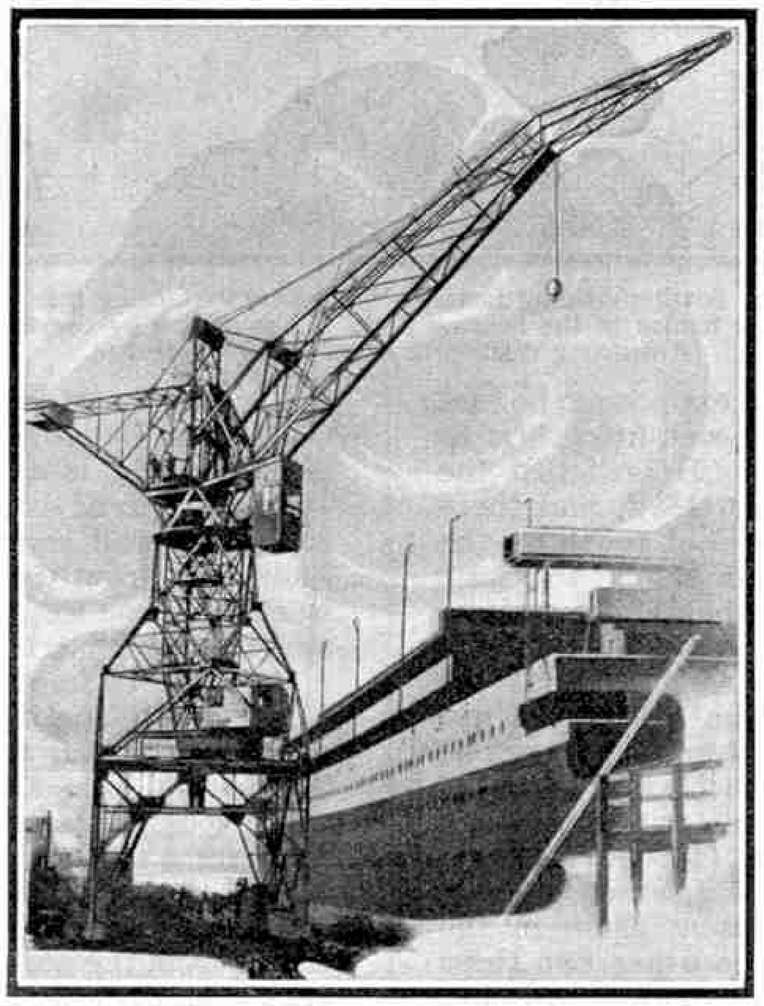


An imposing line of wharfside cranes of the level luffing type. The control and machinery cabins surmounting the wheeled pedestal are a conspicuous feature.

maximum radius of 65 ft. and a minimum radius of 20 ft. The load is lifted to a height of 70 ft. above coping level and can be lowered to 40 ft. below it. The cranes have a slewing range of $1\frac{1}{4}$ turns, and the crane track on which they work is of 13 ft. 6 in. gauge.

The hoisting machinery is secured between the side plates of the pillar, and consists of a hydraulic cylinder fitted with plunger, crosshead guides, 8 : 1 multiplying gear, and $\frac{5}{8}$ in. diameter chain fitted with a lifting hook of special pattern. This chain passes over a sheave at the lower end of the jib and the roller carriage, the proportions of the supporting links and the positions of the fulcrum on the jib being such that the load travels in a horizontal path while luffing. The luffing machinery consists of two hydraulic cylinders acting directly at the top and bottom of the jib roller carriage, for luffing in and luffing out respectively.

At docks where the warehouses are so close to the edge of the quays that there is not sufficient room for the broad gauge track required by mobile level luffing cranes, only the rail nearest to the edge of the quay is laid on the ground. The other rail is laid on a special runway that extends like a balcony along the whole length of a warehouse at a height level with the upper part of the crane pedestal. This one-legged arrangement is very convenient and has been adopted at many docks. Cranes mounted in this manner are known as semi-portal cranes.



A huge luffing crane at one of the fitting-out berths at a shipyard.

Light level luffing cranes are sometimes erected on the roofs of dock warehouses, and the equipment of the Gladstone Dock, Liverpool, includes 46 cranes of this type that travel on tracks laid on the shed roots. These cranes were erected by the well-known firm of Stothert & Pitt Ltd., of Bath, and consist of 29 three-ton cranes and 17 one-ton cranes. The three-ton cranes have a maximum radius of 74 ft. 9 in. when carrying a full load, and this is increased to 85 ft. 9 in. for a load of $1\frac{1}{2}$ tons. At full load they have a lifting speed of 165 ft. per min. and a luffing speed of 170 ft. per min. They can travel at the rate of 50 ft. per min. and when slewing can make one complete revolution per min.

Level luffing cranes are also used extensively in shipyards for lifting materials to different parts of the berths during the construction of the ships. At some yards the cranes are mounted on long gantries that enable them to operate at a great height.

The Romance of Whaling

IV.—Modern Whalers and their Equipment

THE invention of the explosive harpoon gun described last month introduced a method of whaling that was much more effective than the hand harpoon method that had served since the earliest days of whaling. It made possible the hunting of the swift and elusive finwhales that hitherto had been immune from attack. As this is the only species of whale found in Norwegian waters, it was natural that Svend Foyn, the inventor of the gun, should begin there this new form of whaling, which was an immediate success and was quickly adopted by other Norwegian whalers. Thus Norway inaugurated the finwhaling industry, which soon attained such dimensions that during 1885 about 1,000 finwhales were caught off the Norwegian coast.

This great activity in home waters greatly alarmed Norwegian fishermen, and eventually they appealed to their Government to protect their means of livelihood, declaring that the whalers were scaring the fish away from the coastal fishing grounds. Their appeal succeeded, and a Bill was passed prohibiting whaling in Norwegian waters. Compelled to hunt farther afield, the Norwegian whalers then turned their attention to the region of the Faröe Islands, and were so successful there that soon six whaling stations were established on the Islands for receiving and dealing with the dead whales.

The rapid development of the Norwegian whaling industry made it evident that unless it was soon to come to a stop for want of whales, additional hunting grounds must be discovered. When the Norwegians heard in 1892 therefore that a British expedition of four ships was being equipped in Dundee to go in search of right whales in the Antarctic regions, they decided to do the same thing, and that year Captain C. A. Larsen, who became one of the pioneers of modern South Sea whaling, sailed from Norway in the "*Jason*," a three-masted barque equipped with auxiliary steam engines. Larsen had been a whaler for eight years and the knowledge and experience he had gained while hunting whales in northern waters well fitted him to pioneer a southern extension of the industry. He reached the edge of the Antarctic ice pack on Boxing Day, 1892, and there he met the British expedition, which had been sent south on the strength of Sir James Ross' favourable account of his Antarctic exploration in 1842, and to look for right whales where Ross had reported having seen them.

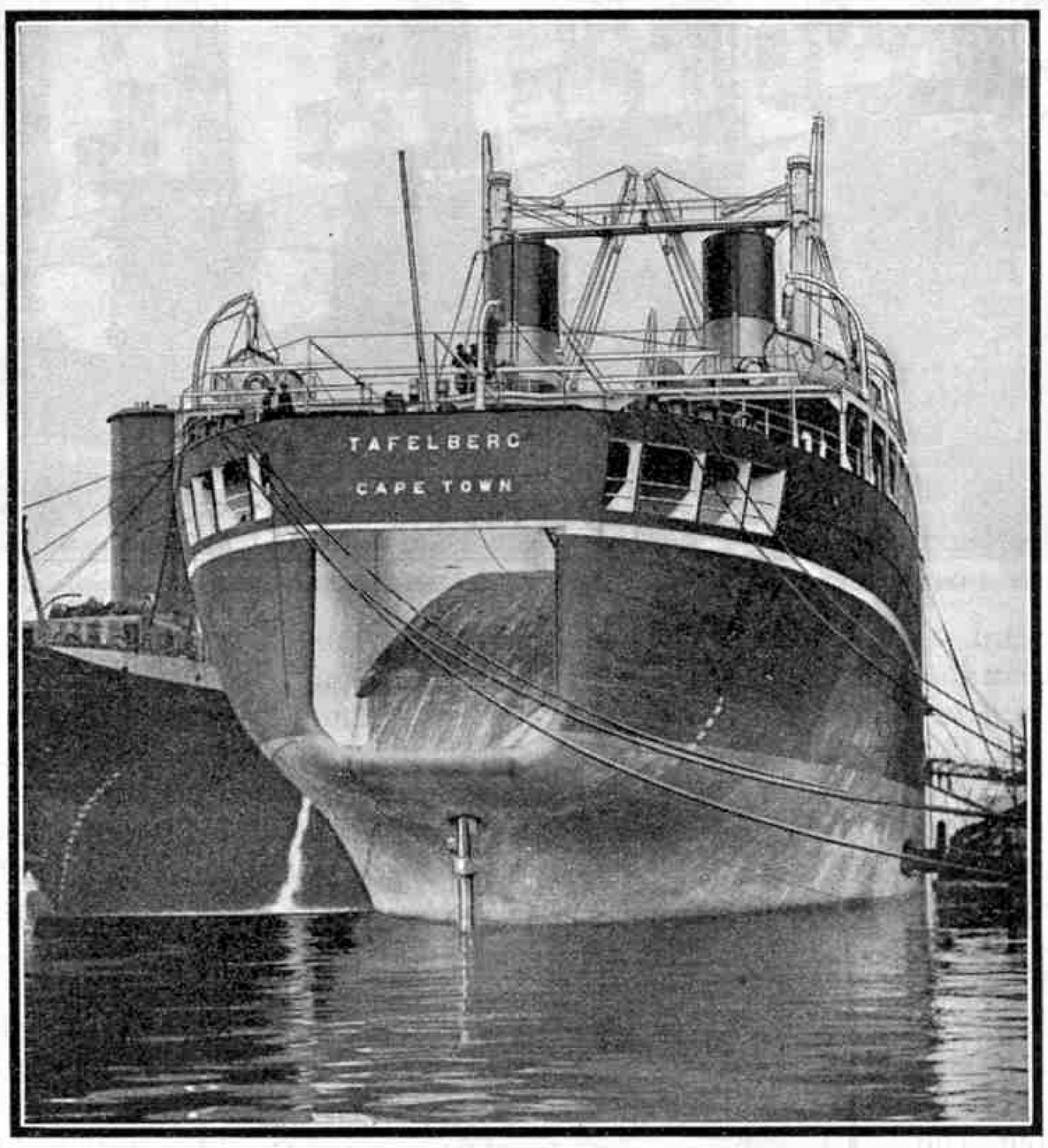
Day after day the sea was scanned in vain for a sight of a right whale. Numerous finwhales were seen, but the ships were not equipped for battle with these elusive and powerful creatures, and finally the captains gave up the search, successfully hunted hundreds of seals, and then returned home. The trip apparently increased Larsen's enthusiasm for exploration, for he revisited the Antarctic region during the following whaling season, accompanied by two other ships. On this trip Larsen, again in the "*Jason*," discovered King Oscar Land, and the other two ships explored the western side of Grahams Land; many finwhales were observed in these parts.

Other scientific expeditions visited the Antarctic during the next five years, but it was only after a Swedish expedition in 1901 that South Sea whaling made any progress. This expedition was led by a nephew of Baron Nordenskjold, the Arctic explorer. His ship, the "*Antarctica*," commanded by Captain Larsen, met with disaster in 1903, being crushed in the ice in the Erebus and Terror Gulf. After months of perilous adventure on the ice the crew were rescued during the following November by an Argentine sloop and taken to Buenos Aires, where Larsen was hailed as a hero of the Antarctic.

Larsen spoke of the abundance of finwhales in the Southern Ocean and of the excellent prospects there for whaling ships equipped to capture these swift creatures. He put forward a scheme for Antarctic whaling on Norwegian lines, and many Argentine citizens favoured the idea. A company was then formed under the name of Compañia Argentina de Pesca, and whaling operations were begun at Grytvik, South Georgia, in 1904. This marked the beginning of the great South Sea whaling industry of to-day, and during the ensuing 20 years additional whaling stations were established at South Georgia, the South Shetlands, and other Dependencies of the Falkland Islands. At the South Shetlands the lack of suitable sites for shore stations made floating factories essential. At first these factories were the hulls of old steamships and sailing vessels, in which were installed the equipment for boiling down the blubber and for storing the oil. Later large converted steamships equipped with modern plants for extracting the oil from the carcases of whales were used, and these in turn have been largely superseded by ships specially designed, constructed and equipped for this work.

A typical example of this latest type of floating whaling factory is shown in the accompanying photograph of the S.S. "*Tafelberg*." This interesting ship was built in 1930 by Sir W. G. Armstrong Whitworth & Co. (Shipbuilders) Ltd., for the Kerguelen Sealing and Whaling Co. Ltd. of Capetown, and is now serving in the Antarctic whaling ground where, in addition to being a floating factory, she acts as a store and parent ship to a fleet of whale catchers. The "*Tafelberg*" has an overall length of 520 ft., a breadth of 72 ft., a depth of 51 ft. 6 in. from the upper deck, and is specially strengthened for working in the ice. She has a deadweight capacity of 16,000 tons, and during her trial run in a fully loaded condition she attained a speed of 12 knots.

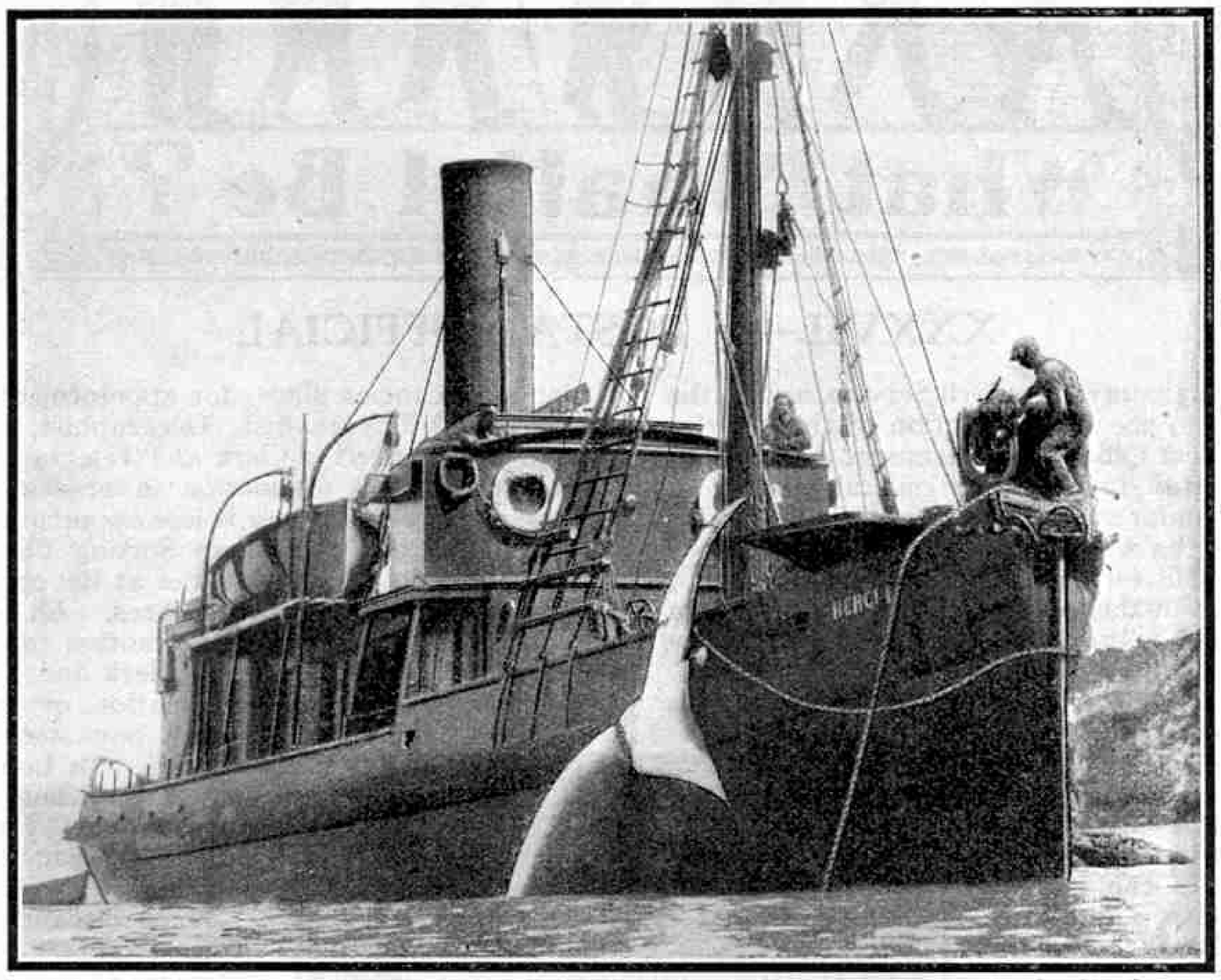
A modern floating whaling factory is unique in many respects and, as the illustration on page 921 shows, the funnels of the "*Tafelberg*" are situated well aft and abreast. This arrangement makes possible a broad expanse of clear deck and leaves adequate room for a slipway about 14 ft. wide that leads up from the waterline at the stern to the flensing deck. The propelling machinery is situated aft as in the case of oil tankers; the plant for extracting the oil from the blubber and meat is immediately below the flensing deck; and below this plant are the spacious tanks for storing the whale oil. The plant, or whaling factory as it is called, includes a most complete equipment of blubber and meat boilers, and



Stern view of the floating whaling factory "Tafelberg," showing the broad slipway up which whales are hauled to the flensing deck. Photograph by courtesy of Sir W. G. Armstrong Whitworth & Co. (Shipbuilders) Ltd.

high pressure boilers called digesters for dealing with whale bone.

The whaling season in the Antarctic extends from about the end of September to the beginning of March, and in view of the long periods during which the "*Tafelberg*" is at sea special attention was paid by the builders to the comfort of the officers and crew, consisting of 250 picked men. In addition to providing for their needs and for her own fuel consumption, the "*Tafelberg*" carries fuel and provisions for the fleet of whale catchers and their crews and, as it is impossible to tell within the limits of the whaling season how long the ship will be away from home, sufficient stores and fuel have to be carried to cover the maximum period. The whale catchers may be exceptionally successful and the floating factory obtain a full cargo of oil fairly early in the season; on the other hand successful catches may come slowly and the factory and its assistant vessels may have to remain at the whaling ground during the greater part of the season before a full cargo is obtained. The late breaking up of the ice pack in the Antarctic regions and the consequent inability of the ships to reach their favoured whaling area promptly is another possible cause of delay that has to be reckoned with.



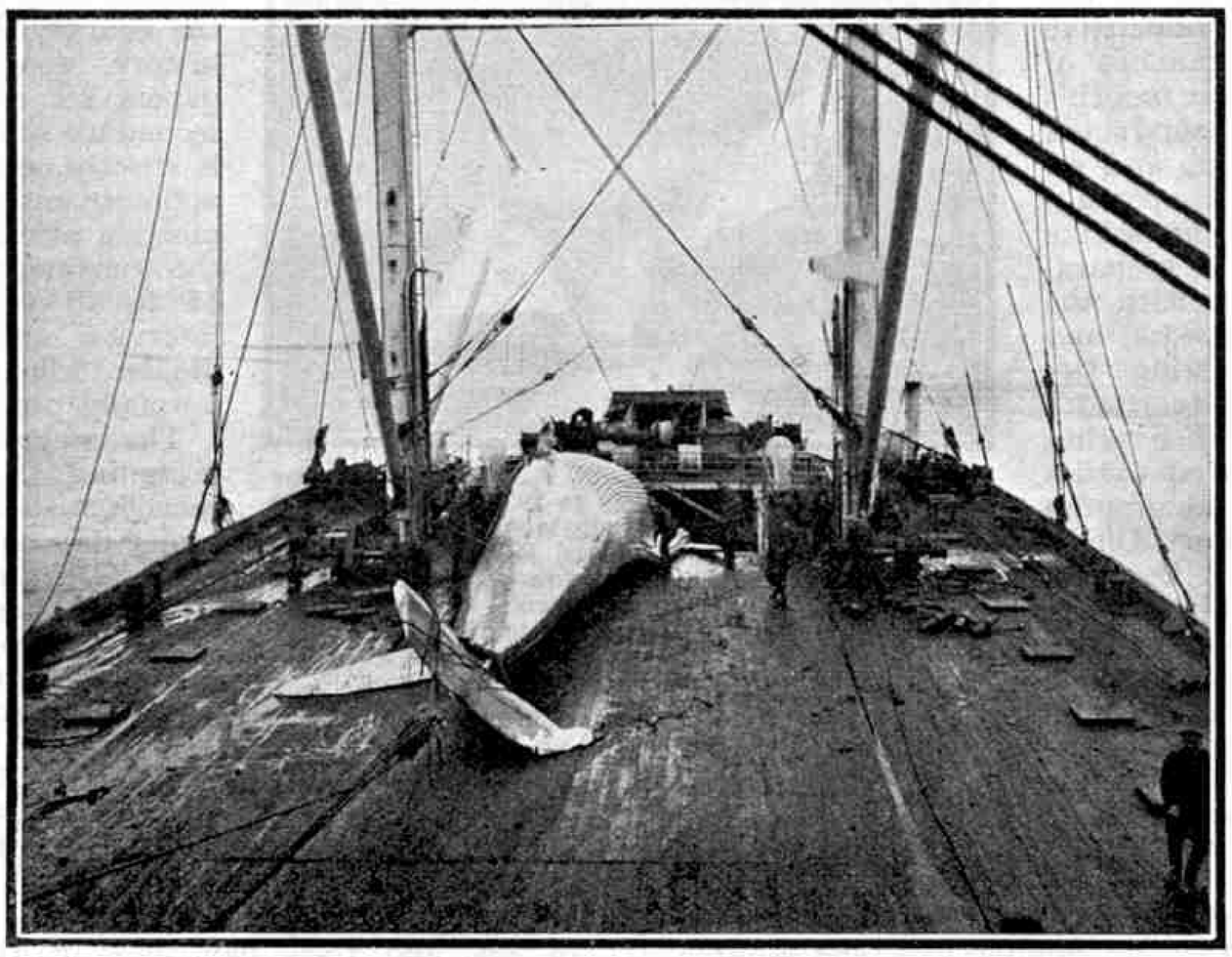
A typical whale catcher. These vessels hunt and capture the whales and tow them to the floating factory. Photograph by courtesy of the Editor of "Compressed Air Magazine."

The parent ship is moored in some convenient sheltered harbour near the hunting ground. This harbour generally is formed by three or four huge icebergs connected together by drift ice and forming an island that provides shelter for the ship. When she has taken up her position two square flags are hoisted to the foremast as a signal that whaling can begin. The whale catchers respond with a blast from their sirens and dash away at full speed. These vessels are sturdy craft of about 150 tons, and they operate over an area extending to 60 or 70 miles from the floating factory. The crew of a whale catcher usually consists of 12 men, the master and gunner, a mate, a steward, two engineers, and the remainder firemen and sailors; and every one of them is a hardy "sea dog."

The life aboard a whale catcher is very arduous, for the hunting and chasing of whales goes on all day and often far into the night, in fair weather and foul; with always the danger of collision with the ice, and sometimes hours of baling and pumping when a heavy bump against the ice has caused a leak below the waterline. This danger is probably never so keenly felt as when a big powerful whale has been harpooned and forges ahead hour after hour towing the whale catcher along. At last, however, the strength of the creature begins to fail, and the catcher, slowly hauling in the line, draws up to the whale. If the victim is a finwhale it begins to sink immediately it is dead, and as soon as the line hangs straight down this is passed to a pair of snatch blocks on the foremast of the whale catcher and from them to a powerful steam winch behind the mast. Strong steel springs connected by wire ropes to the snatch blocks take the shock of any sudden jerks on the harpoon line and thus minimise the risk of the line snapping and the whale and harpoon gear being lost.

When the dead whale has been hauled to the surface a hole is pierced in the carcase and a hollow harpoon is inserted. This tube is connected to a steam driven compressor in the engine room, and compressed air is pumped through it into the whale until this floats easily; and the hollow harpoon is then unscrewed. A chain is passed round the tail of the whale and made fast to the towing rope, after which all is ready for towing the catch to the floating factory. As a rule, however, four or five whales are captured before the catcher returns to the factory. The vessels report their successive catches to the parent ship by wireless telephone.

The whales brought to the factory are hauled tail first up the slipway at the stern of the ship by powerful winches situated on a raised platform above the flensing deck. One of the accompanying illustrations shows a large whale being hauled on deck in this way. This important facility dispenses with the old-fashioned and inconvenient necessity of flensing a whale as it lay alongside the ship, and saves a great deal of time and labour. On the flensing deck the blubber of a whale is removed in long strips, which are passed through a slicing machine and then distributed by pumps to the blubber boilers below. Long curved knives attached to handles about 4 ft. long are used by the flensers, and long practice makes them very skilful at their job.



Hauling a whale up the slipway on to the flensing deck of a factory ship. Photograph by courtesy of Sir W. G. Armstrong Whitworth & Co. Ltd., and the "Discovery" Committee, London.

The flensing of an average whale takes about 30 min., the huge body being lifted and turned as required by means of heavy derricks. The stripped carcase is then hauled to the forward end of the flensing deck where the head is cut off and stripped of all flesh, and the skull and bones are cut into large lumps by powerful steam saws, as shown in one of the illustrations in last month's "*M.M.*" The body is next slit open and the contents are removed; and the backbone is stripped of flesh and the bone sawn into short lengths by the steam saws. The whale bones cut up in this manner are passed to the digesters, while the muscles, tongue and other soft parts are passed to other boilers adapted for their treatment. As the boilers become full, the lids are bolted down and steam is turned on. The cutting up and disposing of an average whale takes little more than an hour, and 19 or 20 whales can be disposed of during a 24-hr. day. The work is carried on continually until all the whales brought to the factory have been dealt with.

The time required for boiling the different parts of a whale carcase varies from one to 15 hours, and the oil drawn from the boilers is passed through centrifugal separators to remove all water, and then to the large storage tanks deep down

(*Continued on page 952*)

XXXVII.—A POSTAL OFFICIAL

LAST month we dealt with careers in the Civil Service, and in the present article we turn to the special section of this Service known as the General Post Office, a Government department that has a monopoly of postal duties. The general method of entry into the Post Office is similar to that described in last month's article, but the character of the work carried on and the variety of types of careers afforded call for special treatment.

The story of postal services in this country down to 1840, when the Penny Post was introduced, is briefly told in the article "Early Days of the Postal Service" that appears on page 929 of this issue. Their later history is more complex, for the carriage of parcels has been added to that of letters, and telegraph and telephone services also are now provided. With these and other extensions of its activities the Post Office has become an extremely important factor in the life of the nation. It is the largest trading concern in the country, and provides employment for some 100,000 workers of both sexes and of all ages.

The work carried on may be divided into two branches, the first being concerned with the operation of the postal, telegraph and telephone services, and the second with the engineering and technical side of these services. In the first of these branches posts are filled partly by selection and partly by competitive examinations conducted by the Civil Service Commission. Entry to the Engineering Department is by competitive examination, just as in the branches of the Civil Service referred to in last month's article. The examinations are conducted by the Civil Service Commission, and an apprenticeship scheme provides openings for those who cannot otherwise undertake the technical training required in preparation. We propose to deal first with the operating branch of Post Office work, and subsequently with the Engineering Department.

The lowest grade in the Post Office is that of Boy Messenger, a position that carries with it for all satisfactory boys the promise of a permanent career in the Post Office. There is no formal examination. Boys are selected between the ages of 14 and 14½ years through Juvenile Employment Exchanges and Bureaux, or in default of these, through ordinary Employment Exchanges. Full information and application forms may be obtained from Exchanges or Bureaux and application should not be made direct to the Post Office. In localities where there is no Exchange or Bureau application should be made to the Post Office.

The work carried out by Boy Messengers consists chiefly of the delivery of telegrams and express letters. During the first two years or so of their employment they are required to attend suitable classes at local continuation schools, if available, for not less than four hours a week. Where possible the courses are so arranged that boys should experience no difficulty in qualifying in the general competitive examination in which those who have attended full courses of instruction are required to take part at 16 years of age. The syllabus includes handwriting, English, calculations, history and geography, and drawing.

The majority of Boy Messengers become postmen, but those who secure the highest places in the general examination and obtain a sufficiently high percentage of marks are considered, as far as vacancies allow, for appointment to the grades of Counter Clerk and Telegraphist, Telegraphist, Sorter and Paperkeeper in London, or Sorting Clerk and Telegraphist in the provinces. The reason for this distinction in grades between London and the provinces is that there is less opportunity for specialisation in the smaller towns, and there Sorting Clerks and Telegraphists are employed on all-round duties at the counter, the telegraph instruments and in the sorting offices. All who are employed in these positions are eligible for promotion to higher positions.

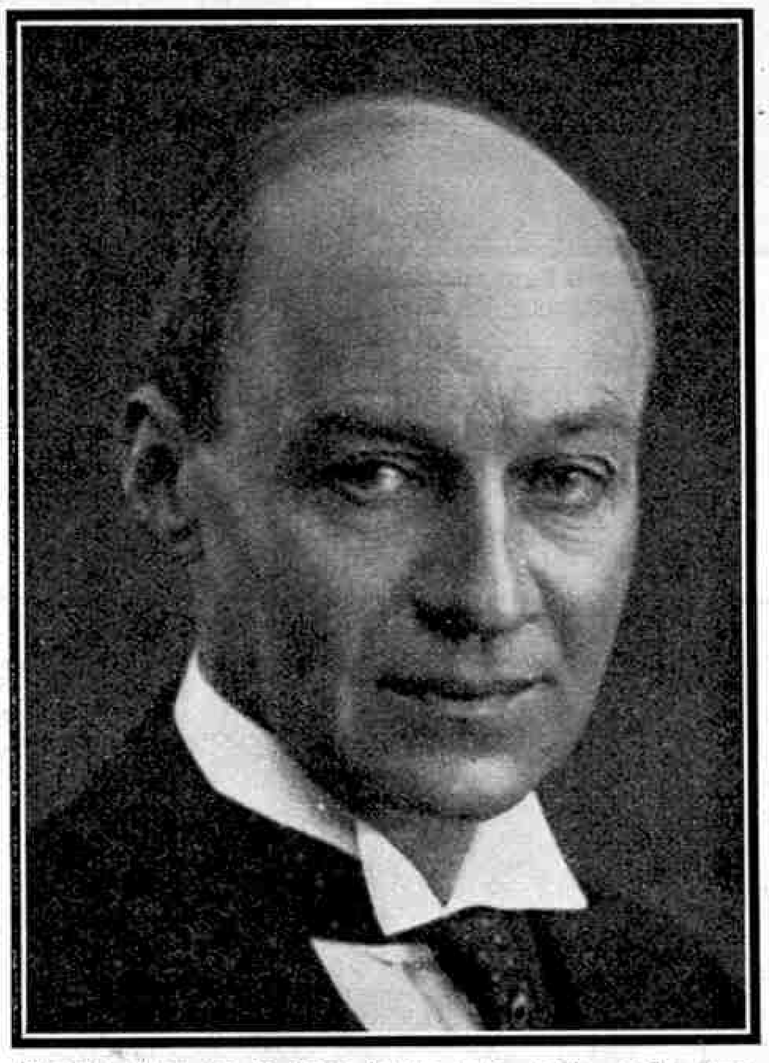
Vacancies in the Sorting Clerk and Telegraphist grades may be filled by competitive examination, or by selection from secondary school boys recommended by their headmasters. In London and other large cities and towns where the duties are specialised, opportunities for appointing boys from outside the Service by one of these methods occur very rarely.

When vacancies are filled by selection from secondary school boys, candidates are interviewed, and if they appear suitable are placed on trial for three months. They have to qualify in an examination, but exemption is granted, at the discretion of the Civil Service Commissioners, to those in possession of the School or Matriculation Certificate, or of an equivalent qualification.

The examination that must be passed by candidates taking part in the open competition is of the same standard throughout the country and the subjects are English, history, geography and arithmetic. The papers set are within the capacity of a secondary school boy, but the examination is strictly competitive, and the offer of an appointment depends entirely on the position attained in it. The age limits for the competitive examination are at present 15 to 18 years; those for selection by interview are 15½ to 18 years, but candidates who are over the age of 16 are normally preferred.

The wages of a Boy Messenger vary according to age. In London he commences with about 12/– a week when he is under 15, and this rises to 24/– by the time he has reached the age of 18. If he becomes a postman he receives 33/– a week at 18 years of age, rising by annual increments to 46/6 at the age of 24, and then to a maximum of £3/6/1 per week. Those who become sorters receive 33/– a week at 18 years of age, annual increases bringing this to 51/9 a week five years later, and eventually to the maximum of £4/12/6 a week. Telegraphists, and Counter Clerks and Telegraphists, receive from 15/– to 18/– a week while undergoing training for their special tasks. When they are qualified they receive 27/– a week at 16 years of age, and their pay rises by the usual annual increases to 42/- a week when they are 21 years of age, and eventually to a maximum of £4/18/8 a week.

The Engineering Department of the Post Office is concerned with the construction and maintenance of telegraph and telephone lines, both aerial and underground; the fixing and maintenance of telegraph and telephone apparatus, including manual and automatic telephone exchanges; the erection and maintenance of wireless stations; and the equipment of fire alarm, electric light, power and other electrical and mechanical installations in Post Office buildings.



The Rt. Hon. H. B. Lees-Smith, P.C., M.A., D.Sc., was Postmaster-General from 1929 to 1931. He was born in India and as he was originally intended for the Army, he became a cadet at the Royal Military Academy at Woolwich, London. Later he resigned his cadetship at Woolwich, and went to Queen's College, Oxford. He began his Parliamentary career in 1910, and, except for a break between 1918 and 1922, has been a Member of the House of Commons ever since.

The Department is under the direction of an Engineer-in-Chief, who controls a large staff of Engineers, Assistant-Engineers and Inspectors, who must receive technical training in electrical engineering in order to qualify them to carry out their special duties. Careers in this Department may be commenced in one of two ways. By means of an apprenticeship system, boys without means to undertake studies beyond the secondary school stage may enter the Post Office and combine practical work with further technical training. Young men entering the Service at later stages may take part in the open competitions for appointment as Probationary Inspectors or Probationary Assistant-Engineers. The qualifications required are high, particularly in the case of Post Office Engineers; and those who wish to take the examinations for Assistant Engineers must attend a University course in engineering, or its equivalent, and take a degree.

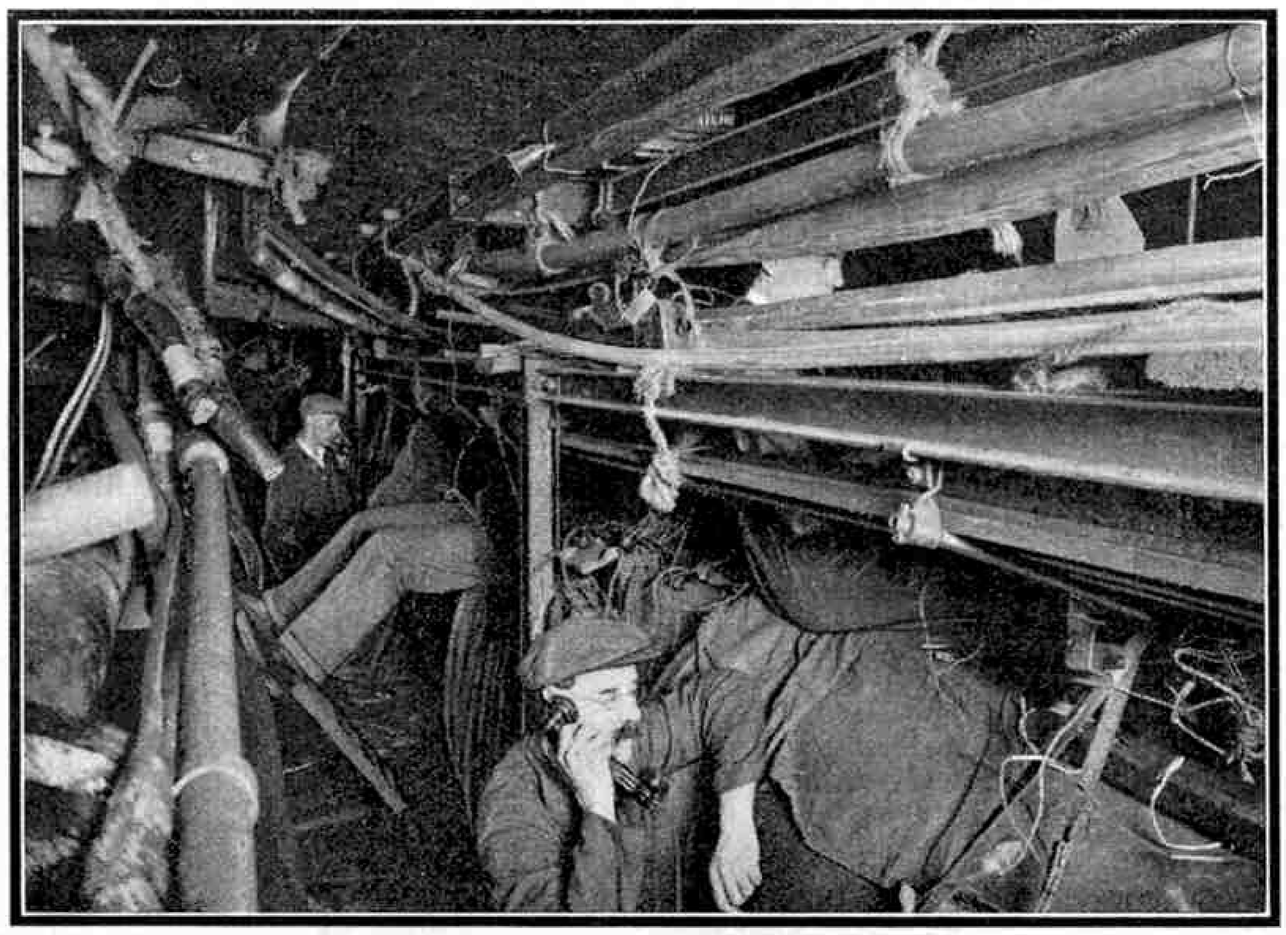
Boys who enter the Engineering Department of the Post Office under the apprenticeship system referred to are included in what is known as the Youth-in-Training grade. They are accepted at the age of 16, and may be admitted up to the age of 18½. An education of secondary school type, preferably one in which matriculation standard has been attained, is looked for, and the study of electrical science at a technical college is a useful supplementary qualification, although it is not regarded as absolutely necessary for those who come under the scheme in the earlier years. A real interest in electricity is necessary to a successful career in the Post Office Engineering Department, and the pursuit of hobbies connected with electrical subjects is useful to boys entering this branch of the Service.

Application for admission as a Youth-in-Training should be made to the Post Office Superintending Engineer, Denman Street, S.E.1, by those seeking entry in London; and where employment in the provinces is required to the local Sectional Engineer, whose address may be obtained at the local Post Office. These officials will give any further information that may be required, and will supply copies of a pamphlet describing the scheme in detail.

In the early stages of their training boys are engaged in assisting skilled workmen in carrying out certain classes of work, and during this period they gain practical knowledge of various types of plant and apparatus. They are expected to undertake a course of technical study at evening classes, the fees for which are paid by the Post Office if certain conditions are complied with.

The ordinary method of advancement for a Youth-in-Training is through the grade of unestablished skilled workman, who is not eligible for pension on retirement, to that of the skilled workman who is entitled to such a pension, and therefore is described as established. He then proceeds to the position of Inspector, which is reached either by promotion or by examination. Ambitious youths endeavour to secure more rapid advancement, however, studying in their spare time in order to be able to take part in the open competitions for positions of Probationary Inspector and Probationary Assistant-Engineer. The regulations for these competitions are dealt with later in this article, and Youths-in-Training may compete in them under the same conditions as outside candidates. In addition to the open competitions for these posts, special examinations limited to men already serving in the Post Office are held, and Youths-in-Training are admitted to them after completing five years' satisfactory service.

Young men who have pursued their scientific and electrical training somewhat beyond the usual secondary school standard may enter the Department as Probationary Inspectors. An open competition for this grade is usually held once a year. The age limits are 17 to 23, and the subjects of the examination are pure mathematics, applied mathematics, electricity, and heat, and engineering drawing and design, with an additional paper on a special scientific subject selected from a given list. The personal qualities of candidates are also assessed by means of an interview.



Cable engineers of the G.P.O. repairing damage in an underground cable tunnel. For the two illustrations on this page we are indebted to the courtesy of the General Post Office.

An open competitive examination of a higher standard is that for the post of Probationary Assistant-Engineer, and this also is usually held once a year, the age limits being from 20 to 25. There are four compulsory subjects, mathematics, electro-technology, strength of materials, and theory of machines, with a further paper on alternating currents, electrical machines, heat engines, or telegraphy and telephony. Candidates must have passed an examination qualifying for an honours degree in engineering, after attending an institution of University rank, or have obtained an equivalent training and qualification. An interview forms part of the examination, in order to enable the examiners to assure themselves that those appointed possess the necessary personal qualities to fit them for their duties. This examination is now under review, and considerable changes in the regulations may be made in the near future.

Telegraphists at work in the Central Telegraph Office, London.

Probationary Assistant-Engineers and Probationary Inspectors are usually employed for the first three months in London, where they undergo a course of training at Headquarters. They must be prepared to serve in any district in Great Britain and Northern Ireland, and there is a general liability to serve abroad for short periods. The Probationary service lasts two years.

In his first year a Probationary Inspector receives £209/4/– if employed in London, and £190/15/– in the provinces. The maximum salaries of qualified Inspectors are £300/1/– a year, and £282/10/– a year in other parts of the country. Inspectors are eligible for promotion to posts as Chief Inspectors, with correspondingly higher pay. During their first year Probationary Assistant-Engineers receive about £270/15/– if employed in London, and £246/3/– in the provinces, the maximum salaries in this grade being £526/16/– and £505/7/– in London and the provinces respectively. These salaries include the cost-of-living bonus.

An interesting Post Office career that will be attractive to many boys is that of Assistant Traffic Superintendent (Telephone). Officers of this grade are concerned with the development and supervision of operating methods, and with arrangements for the provision of equipment for the efficient disposal of telephone traffic. Entry is by open competition, with

(*Continued on page 952*)

The Discoverer of Electro-Magnetic Waves

Heinrich Rudolf Hertz

ONE of the greatest names in the history of electricity is that of Heinrich Rudolf Hertz, the brilliant German scientist, who in 1887 first demonstrated practically the existence of electro-magnetic waves, or wireless waves as they are now usually called. This discovery had been predicted many years earlier by James Clerk Maxwell, the famous British mathematician. Maxwell was greatly interested in the ideas of Michael Faraday in regard to electrical forces. Faraday was convinced that the interactions between electrically-charged bodies were due to stresses set up in the ether between them. In working out the effects of this point of view Maxwell came to the conclusion that electrical influences would travel outward in a series of waves in the ether. These waves would produce magnetic as well as electrical effects, and therefore were given the name of electro-magnetic waves. He predicted that they would be of the same nature as light waves, and would travel at the same speed.

By 1873 Maxwell's conclusions were generally accepted, but the problem still remained of detecting the existence of these electro-magnetic waves. There were several possible sources, and as early as 1883 it was suggested that the discharge of a Leyden jar would produce them, for this discharge is oscillating. The current surges backward and forward across a spark gap included in the circuit through which the jar is being discharged, and the effect dies away comparatively slowly instead of suddenly. Detecting the waves was more difficult than producing them, however, and it was by devising the first really successful means for doing this that Hertz laid the practical foundation of modern wireless.

Hertz was born at Hamburg on 22nd February, 1857, and while at school had the ambition to become an engineer. He actually studied engineering at Munich, but he discovered that he was more interested in mechanical theories than in the practical details of the mechanisms. He changed his plans, therefore, and took up the study of experimental physics at Berlin University, where he attracted the attention of the authorities by his thoroughness. He won a prize for the best solution of a difficult electrical problem, and was at once placed on research work under the direction of Helmholtz, the great scientist and teacher.

On leaving Berlin Hertz went first to Kiel and then to Karlsruhe as Professor of Physics. In the meantime he had become acquainted with Maxwell's electro-magnetic theory, and realised that the sudden discharge of a condenser probably would set up electric waves in the ether. He had thought of trying to prove the existence of these waves, but as he was not in possession of suitable apparatus, he had abandoned the idea.

In 1885 his attention was again directed towards this problem. Among the laboratory apparatus at Karlsruhe he found an old pair of short flat coils of insulated wire, with the turns all in the same plane. One day he was experimenting with these coils, and he noticed that the discharge of a Leyden jar through one of them induced an appreciable current in the other, provided that there was a tiny spark gap in the first coil.

This accidental discovery started Hertz on the track of his subsequent successes. He quickly followed it up by constructing a more satisfactory apparatus, consisting of two parts, the exciter and the detector, or "resonator" as he called it. The exciter was formed of a pair of metal rods placed in line with each other, terminating at one end in polished brass knobs about $\frac{1}{2}$ in. apart, and at the other end in large zinc plates. These plates formed the two surfaces of a condenser, the capacity of which could be adjusted by varying the distance between them. Electro-magnetic waves were excited by connecting the rods to the terminals of an induction coil, so that sparks were made to jump across the gap between the two balls. The resonator consisted of a wire bent in the form of a circle, but having a small gap, the ends of which terminated in metal balls. This wire ring was placed a short distance away from the exciter, and when the latter was set in action, sparks were seen to jump across the gap in the resonator, although this was not connected in any way with the exciter.

Hertz showed wonderful experimental skill in working with this simple apparatus. At first he did not seem to realise what his results meant and did not make use of the words "electric waves" when describing his experiments, speaking instead of the spreading out of the electric force. Later he grasped the importance of his discoveries, however, and proved conclusively that he had produced electro-magnetic waves of the kind that had been foreseen by Maxwell, and showed that these obeyed the same laws as light waves. He discovered that they were propagated in straight lines, and he produced "electric shadows" by setting up metallic screens in their paths. He reflected them from a gigantic mirror formed by bending a sheet of zinc into a parabolic shape; refracted them by passing them through a large prism made of pitch; and measured the speed with which they travelled through the ether, finding that this was exactly the speed of ordinary light waves. This experimental work proved beyond doubt that light and electro-magnetic waves were identical in their essential details, differing only in wave-length.

Heinrich Rudolf Hertz (from the Editor's book "Pioneers of Wireless" by permission of Methuen Ltd.).

Hertz made no attempt to turn to practical use a discovery that was to him not a commercial proposition, but simply an amazing confirmation of a complicated mathematical theory. It is remarkable that he did not consider the Hertzian waves, as they came to be called, to be of any use as a means of communication without wires. Huber, a civil engineer of Munich, suggested their employment for this purpose, but Hertz discouraged the idea, for at that time he did not know of any sufficiently sensitive means of detecting electro-magnetic waves of low intensity. He thus missed an opportunity of adding still further to his fame.

It is curious to reflect that a suitable means was then actually in existence. David Edward Hughes, the inventor of the microphone, had produced electro-magnetic waves as early as 1879, making use of his microphone as a detector, but he had been discouraged from carrying his experiments further by the disbelief of scientists who witnessed them. They were greatly impressed when he produced a current in a receiving circuit by interrupting that passing through a coil in another room, but did not accept his theory that electric waves were responsible for his results. But for this Hughes probably would have forestalled Hertz's discovery by 10 years, but this, of course, does not in any way detract from the skill with which Hertz carried out his work.

In 1889 Hertz became Professor of Physics at Bonne, where he continued his studies of electrical discharges through gases, a subject in which he had long been interested. In one of his experiments he found a mysterious invisible ray, and in this he narrowly missed discovering the X-ray recognised a few years later by Röntgen. He died on 1st January, 1894, at the early age of 37, and thus did not live to see the amazing manner in which his discovery was turned to practical use by Marconi and other wireless pioneers and inventors. In his short life as an experimental scientist, however, he effected an achievement that marks him as the founder of an epoch in experimental physics.

Early Days of the Postal Service

From Post Bag to Mail Coach

THE efficiency of the present-day postal system contrasts strangely with the crude organisation that sufficed until almost a century ago. Down to the time of Henry VIII the British postal system was a spasmodic affair that came to life only during periods when the country was at war, and even then was limited to correspondence between the Royal Court and the scene of hostilities.

In 1533 Henry VIII appointed Sir Brian Tuke to be the first "Master of the Posts," and instructed him to set up posts "in all places most convenient." Sir Brian had to see that horses were always ready at certain points for the use of the messengers carrying the Royal mail. On the regular post roads these relays were maintained at the King's expense, but if it was necessary for the courier to travel by some other road, the townships en route were under obligation to provide the necessary horses, irrespective of whether the courier was carrying letters or not. One of the duties of the Master of the Posts was to make sure that towns did not forget this obligation. If the courier found it necessary to renew his mount at some place where this provision was lacking, and if a fresh horse was not produced within half-an-hour of his arrival, the local magistrates and constables were compelled to commandeer the first horse they could lay hands on to enable the courier to speed on his way.

The envelope of a letter posted in 1824, before the days of adhesive stamps.

The post-horse system was established solely for the King's purposes, but it was sometimes utilised by private individuals who pretended they were travelling on the King's service and thus obtained relays of horses that otherwise would have been denied them. Sometimes also the couriers were not averse to delivering a little private correspondence on their way when it was made worth their while to do so.

The main roads of England in the 16th century were merely pack-horse tracks that were the original winding paths followed by peasants on foot, avoiding marshes and taking devious ways over the hills. There were only four regular post roads, to the Continent via Dover, to the Royal Dockyard at Plymouth, to Scotland via Berwick, and to Ireland by way of Beaumaris. The most important road was that to Dover.

The post-horse services were slow and unreliable, and often the postmen served for long periods without receiving any wages. Queen Elizabeth did not improve matters by decreeing that the postmen's wages must be reduced by half. Apparently the practice of commissioning the Royal messengers to deliver private letters in the course of their journeys had increased, for Elizabeth decreed that letters other than those of the Court should be considered of no account, and that nobody should induce a Royal messenger to ride with private letters. This restriction would have been a severe one but for the fact that in those days there were few people who troubled to write letters. The charge to members of the Court for the use of the post-horse services was 2½d. per mile for the horse, and a food allowance of a measure of groats for the messenger. Only postmasters were allowed to keep post-horses, or to collect and deliver letters.

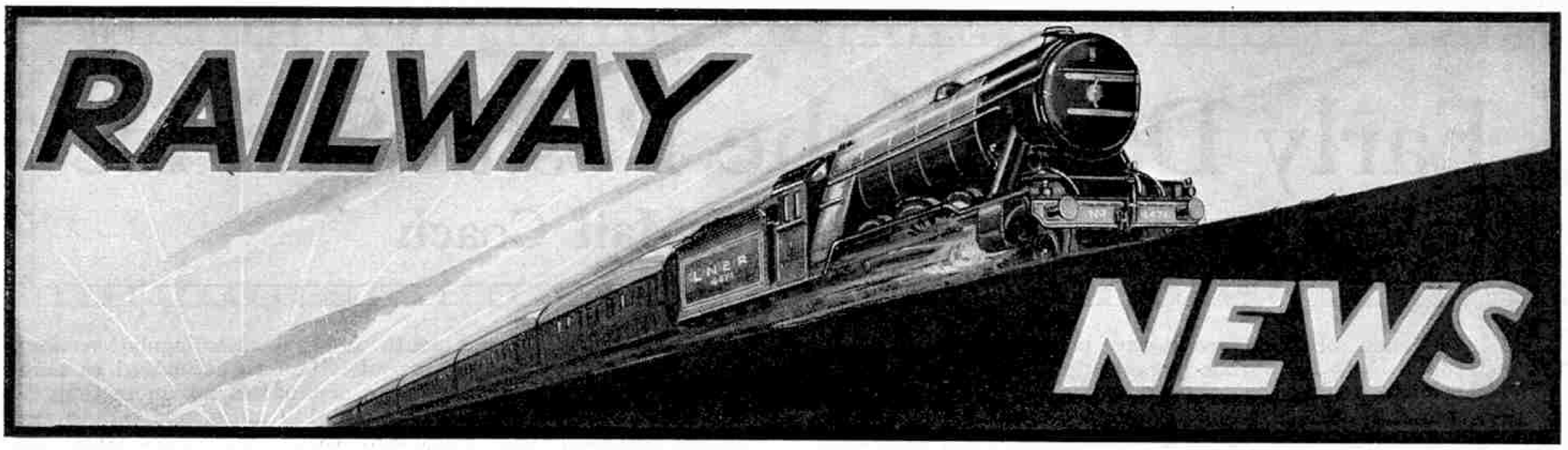
In 1635 packet posts were established throughout the country, and resulted in communication between London and Edinburgh being shortened from one month to one week. Regulations were issued limiting the conveyance of letters to authorised carriers. A single letter cost 2d. to send a distance of not more than 80 miles; 4d. to send between 80 and 140 miles, and 6d. to any greater distance. The mails were carried by "post boys" on horseback, who travelled at an average speed of four or five miles an hour. Letters between intermediate towns on or near each main road were conveyed by carriers known as "by-posts"; but a letter from a town in the region of one main road to a town similarly situated in regard to another had to be sent to London, and there transferred to the mail for the road concerned. Postage was calculated on distance via London, and consequently the charge was often out of all proportion to the actual distance between the place of despatch and the destination of the letter.

Adhesive postage stamps had not then been introduced, and the amount of the postal dues was stamped on the envelope and payment made by the recipient of the letter. A plan that was often adopted to evade the heavy dues was to communicate by means of secret marks on the outside of the envelope. When the postman delivered the letter and demanded payment, the recipient glanced at the marks on the envelope and handed back the unopened letter to the postman, having obtained the message without payment.

When passenger stage coaches capable of travelling at some 10 miles per hour came into use, it occurred to John Palmer, a theatre proprietor of Bath, that it would be safer and speedier to convey mails by this means than by post boys on horseback. He therefore put forward a scheme for an organisation of mail coaches. After some consideration his proposals were adopted by the Government, and he was appointed Comptroller-General of the Post Office. The first mail coach ran in 1784 on the London-Bristol road, and other services followed until eventually there were 42 of them in operation. The driver of each coach was accompanied by a Post Office guard, and both were well armed. The services linked up 60 of the most important towns in Great Britain, and also collected and deposited mail at many intermediate towns. The speed of the coaches and the presence of the armed guards kept them immune from "hold-ups" for a long time, and not a single mail coach was stopped or robbed during the first eight years the services were in operation. Places off the mail coach routes were served by "cross post" carriers, however, and hardly a week passed without one or two of these riders being attacked in some lonely place and the mail stolen. In spite of the high charges for the delivery of mail, the mail coaches were a great success, and remained supreme until the introduction of railways nearly 50 years later.

The pre-coach system of conveying all mails by post boys on horseback cost the Government about £25,000 a year, and the introduction of mail coaches on the main post routes reduced this heavy expense by half. Every year, on the King's Birthday, the mail coaches paraded in London, the procession being led by the Bristol coach, as this was the oldest established mail.

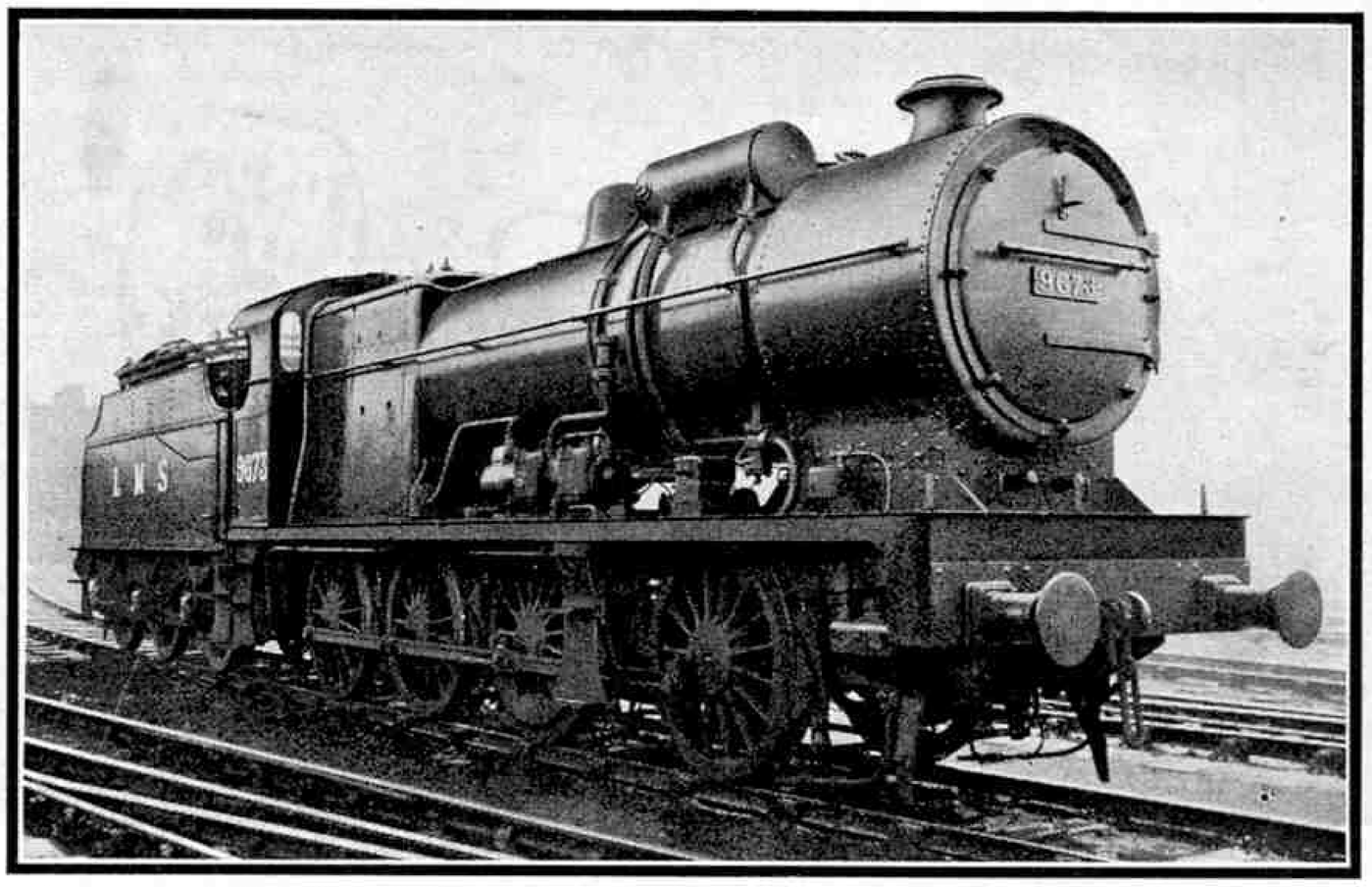
A uniform penny post was introduced in January 1840, and in May 1840 the first adhesive postage stamps were issued.



A.C.F.I. Heaters on the L.M.S.R.

Feed-water heaters of the A.C.F.I. pattern have been fitted to three standard 0–8–0 mineral engines engaged on heavy duties on the L.N.W.R. section of the L.M.S.R. These are Nos. 9672, 9673 and 9674, and one of them is illustrated on this page.

The A.C.F.I. heater is of the direct-contact type, heat being reclaimed from exhaust steam. This is taken to a mixing chamber on top of the boiler, where it meets cold water pumped from the tender, the water entering the chamber through a perforated pipe so that it falls through the exhaust steam as a fine spray. The heated feed water passes to a settling tank alongside the mixing chamber, where an outlet allows the escape of oxygen and carbon dioxide set free by the rise in temperature, thus reducing liability to corrosion. It is then pumped into the boiler through a clackbox in the usual manner. More water is supplied to the mixing tank than the pump can deal with, the excess of cold water being returned to the tender feed pipe.



L.M.S.R. standard 0-8-0 locomotive No. 9673, fitted with A.C.F.I. feed-water heating apparatus, as described in the paragraph on this page. Photograph reproduced by courtesy of the L.M.S.R.

Our photograph clearly shows one of the tanks or chambers on top of the boiler and the water and exhaust steam pipes connected to it. It will be noticed that the engine is provided with the latest style of L.M.S.R. tender, having the rivet heads showing, as now standard, and having additional coal rails to increase its fuel capacity.

New 2-6-2 Tank Engines for G.W.R.

At Swindon works steady progress has been made with the order for 20 tank engines of the 2–6–2 " 6100 " class and it is expected that all will be finished before Christmas. A number of " Kings " have been through the shops for a thorough overhaul after a long and arduous season dealing with the heavy holiday traffic. Some speedometers of different types have been tried recently on several of the " Kings," with interesting results.

The scrapping of the 4–4–0 locomotives of the " County " class has been proceeded with and the class is now almost extinct. Several of the " County " tanks (" 2200 " class) have also been cut up during this year.

Closing of L.M.S.R. Steel Works at Crewe

Five engines of the new series of 2–6–2 tanks under construction at Derby works have been completed and are numbered 15560–4. Another " Claughton "—No. 5966—has been reconstructed at Crewe as a 3-cylinder " Baby Scot " and is now stationed at Camden Shed.

The steelworks that for so many years occupied a distinctive place in the famous railway shops at Crewe have been closed down permanently. This step was decided upon with reluctance, but the Company felt that it was no longer possible to manufacture steel economically at their own works. There is no intention to abandon Crewe as a centre of railway activity and certain subsidiary workshops are to be concentrated there.

Electric Services on Brighton Line

The electric services on the S.R. main line between London and Three Bridges are operating very satisfactorily. They are attracting additional traffic and a fair measure of punctuality is being sustained. The through electric services to Brighton and Worthing are to come into operation on 1st January and it is expected that a very high standard of reliability and punctuality will then be realised. Meanwhile the interposing of the full steam services to Brighton, Worthing, Reigate and other places, with the new electrics is a decided handicap. The position will be much easier when the " steams " to these places cease to run. There will be many regrets, however, at the disappearance of the long-familiar steam locomotives.

In readiness for the new services, a new system of colour light signalling has been installed and brought into use, and the Southern Railway now possess by far the longest continuous installation of colour light signalling in Great Britain. It extends from Coulsdon and Earlswood as far as Brighton station, a total of nearly 120 miles of track, the whole of which is electrically controlled and signalled. Many of the signals are worked by the trains as they pass without any action on the part of the signalman. At Brighton, one new signal cabin has superseded six that were used under the old system.

L.N.E.R. Locomotive News

Darlington works continue to turn out standard 0–6–0 locomotives of the " J39 " class and Nos. 1469 to 1480 are now in traffic. Another of the G.E.R. 4–6–0 express locomotives—No. 8580—has been rebuilt with a larger boiler of the type fitted to engines Nos. 8576 and 8579, as described in last month's *"M.M."* These engines have always been noted for steaming power, and the change should largely increase their capacity in this direction.

Mammoth Locomotives for Russia

Some enormous locomotives of a new type, having a wheel arrangement of 2–14–4, have just been set to work on the Russian Railways. Their appearance is noteworthy because in them for the first time seven coupled axles are employed in locomotives with rigid frames. They have been built to haul coal trains of 3,000 tons weight between Donetz and Moscow. All the dimensions of these engines are huge. The grate area amounts to 107 sq. ft. The total heating surface, including that of the superheater, is 6,645 sq. ft. and the working pressure is 227 lb. per sq. in. There are two simple cylinders, of 29 in. diameter and 32 in. stroke, which drive the fourth coupled axle. The coupled wheels have a diameter of 5 ft. 1 in. The total engine weight is 186 tons, of which 137.75 tons are available for adhesion. The tractive effort is 70,000 lb.

More Speed Records on the L.M.S.R.

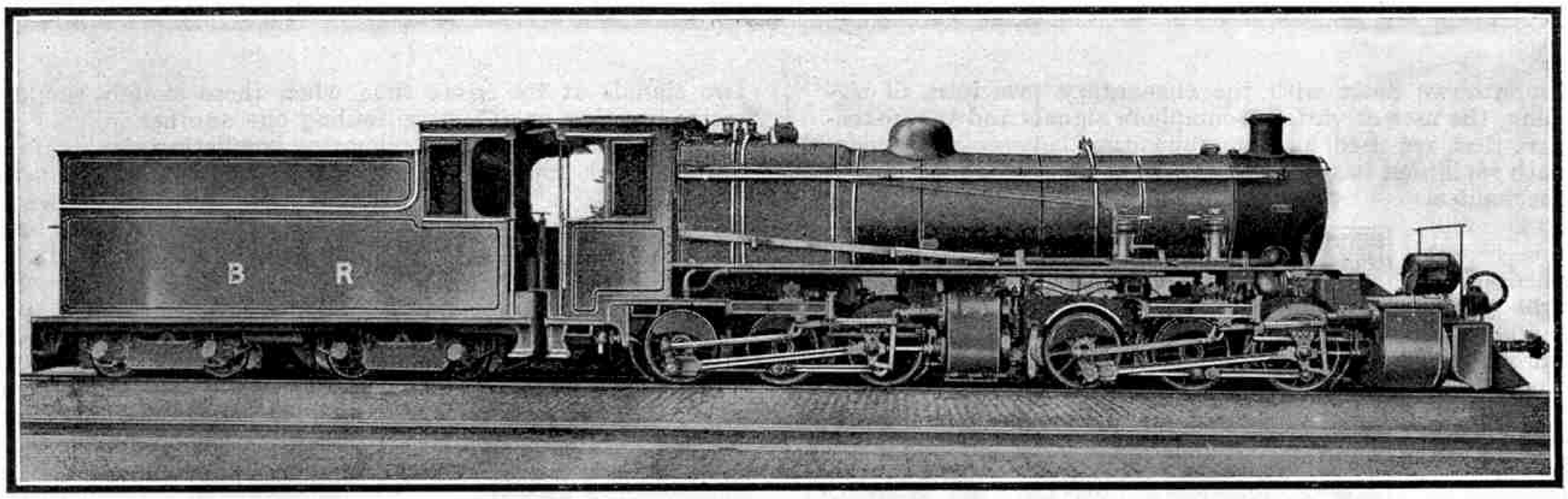
In the months that have passed since the accelerated services came into force on the L.M.S.R. the "Royal Scot" locomotives have increasingly shown themselves capable of maintaining the new very fast schedules. Even the fastest expresses are rarely late and quite frequently they arrive before time. Thus "*The Comet*," the new 3¼ hr. Manchester-London express, which is timed to cover the 133½ miles from Stafford to Euston in 127 min. at 63.1 m.p.h., in its first 24 journeys arrived at Euston before time on eight occasions but was late only thrice.

Many persons have wondered why the name "*The Comet*" was given to this express. The answer is that not only does "*The Comet*" symbolise speed, but it embodies the initial syllables of "COttonopolis" and "METropolis," familiar names for the cities linked by this train. "*The Comet*" leaves Euston each week-day at 11.50 a.m. and arrives at Manchester at 3.20 p.m. On the return journey, Manchester is left at 5.40 p.m. and Euston reached at 8.55 p.m.

A correspondent has sent the log of an excellent run made by the express leaving Crewe at 10.35 a.m. and due at Euston at 1.15 p.m. The engine was "Royal Scot" No. 6146, "*Jenny Lind*," of Bangor shed, in charge of Driver Devereux, also of Bangor. The load was 13 coaches, weighing 403 tons. Crewe was left five min. late but Euston was reached two min. early, the 158.1 miles having been done in exactly 153 min. A maximum of 82 m.p.h. was touched at Castlethorpe. Our correspondent rightly adds: "It shows that the new timing even with such a load presents no trouble."

Some extremely fast times were achieved when two special trains were run recently from London to Coventry and back. Each train was made up of 10 coaches weighing, with passengers, about 300 tons. The first flyer was hauled by engine No. 6100, "*Royal Scot*," and on the outward journey, the 94 miles were covered in 86 min. 47 sec., an average of 65 m.p.h. On the return journey an overall time of 83 min. 4 sec. was achieved, giving an average of 67.9 m.p.h. A maximum speed of 88.3 m.p.h. was attained between Boxmoor and King's Langley.

The second special was drawn by engine No. 6109, "*Royal Engineer*." The down journey was done in the very sharp time of 82 min. 42 sec., showing an average of 68.2 m.p.h. Tring (31¾ miles from Euston) was passed in 30 min. 45 sec., and the speed at the summit was 67.3 m.p.h. On the falling grades beyond, a speed of 84.8 m.p.h. was reached. Returning, 83 min. 40 sec. were taken for the 94 miles, so averaging 67.4 m.p.h. A speed of 86.5 m.p.h. was twice attained, first near Boxmoor and later at Wembley. The 15 miles, mostly uphill, from Bletchley to Tring were covered in the remarkable time of 11 min. 50 sec.—an average of over 75 m.p.h., and even at the summit the minimum speed was 72.6 m.p.h.! The merit of these achievements is enhanced by the fact that severe reductions of speed had to be made by both trains in each direction.

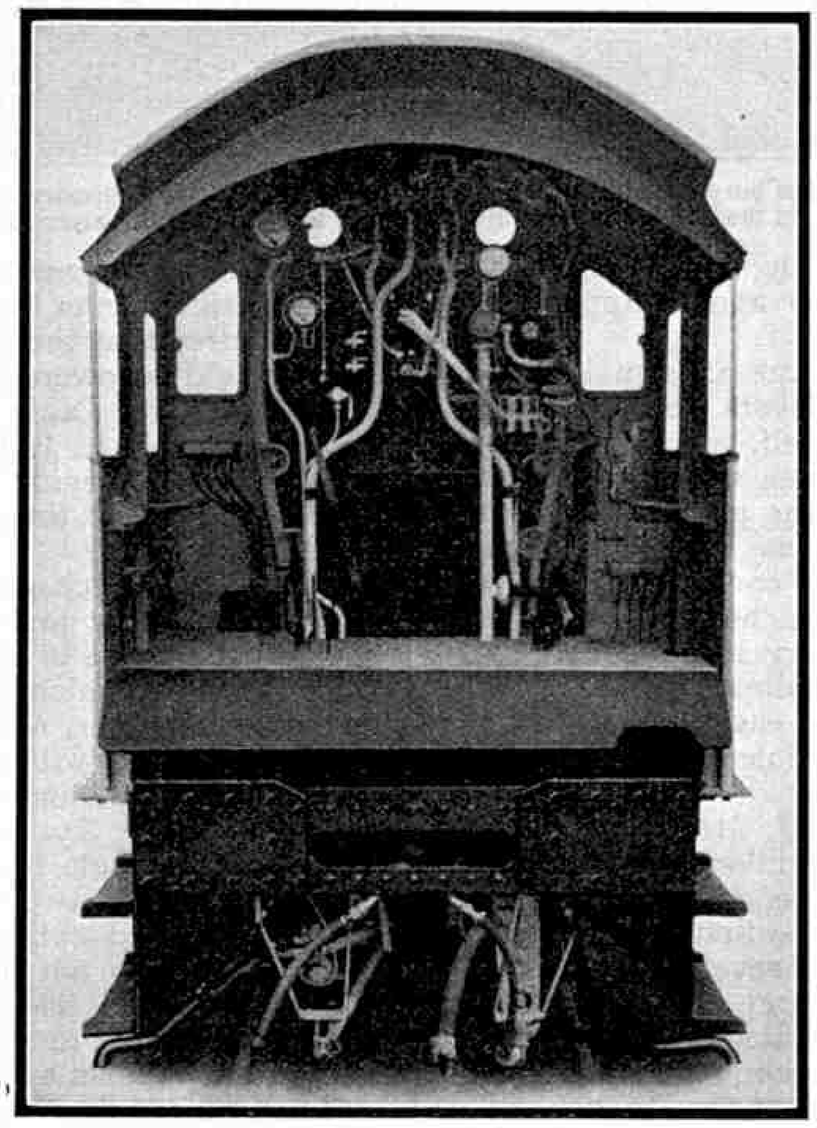


An interesting 0-6-6-0 "Mallet" compound locomotive of the Burma Railways. Many characteristic features of overseas locomotives will be noted, such as the tender cab, the shutters on the cab side and the large headlight. Lifting jacks are carried on these engines and two of these may be seen on the running plate.

Bow Works, L.M.S.R.

The locomotive works at Bow, in East London, which were built for the North London Railway about 80 years ago, are still in active operation, and, indeed, in late years have acquired an added importance. Since the formation of the L.M.S.R. in 1923, while the railway shops at Plaistow and Kentish Town have been closed, those at Bow have been improved by the installation of new machinery. Repairs of all kinds to the locomotives working on the North London and the Tilbury and Southend sections of the L.M.S.R. are now carried out at Bow in addition to service repairs to engines from other sections. Among the engines overhauled there recently was No. 13129, a standard 2–6–0 "Mogul" fitted with Lentz poppet valve gear.

All the 4–4–0 tank engines that so long worked the passenger traffic on the North London Railway have been broken up with the solitary exception of No. 6445, which is preserved at Derby as a "historic" locomotive. Of the handy 0–6–0 goods tank engines with outside cylinders, six have been scrapped, but the remainder all continue in service. Three of them—Nos. 7511, 7515 and 7521—have lately been appointed to new duties in an area somewhat distant from their old familiar haunts, for they are now working on the High Peak line in Derbyshire. Before being sent to this new work they were equipped with screw-reversing gear.



A view of the cab of a G.W.R. "Castle" locomotive. The "Castles" were the first G.W.R. engines to have the modern side-window cab with extended roof.

Improved Continental Services

Although decreased traffic has made some curtailment of the Continental services necessary during the present winter, excellent facilities are still provided and some improvements have been effected. The 4.0 p.m. from Paris (Nord) to London via Boulogne and Folkestone has been greatly accelerated with the result that the journey from Paris to London is done in 6 hr. 25 min.—the fastest time on record for the through rail and boat journey. In the reverse direction a saving of five minutes has been made by the 4.0 p.m. service from London (Victoria).

The famous motor-carrying ship S.S. "*Autocarrier*" is sailing daily during the winter months between Folkestone and Boulogne for the convenience of motorists taking cars to and from the Continent. Ordinary passengers are also carried by this service.

Monster Freight Cars on C.N.R.

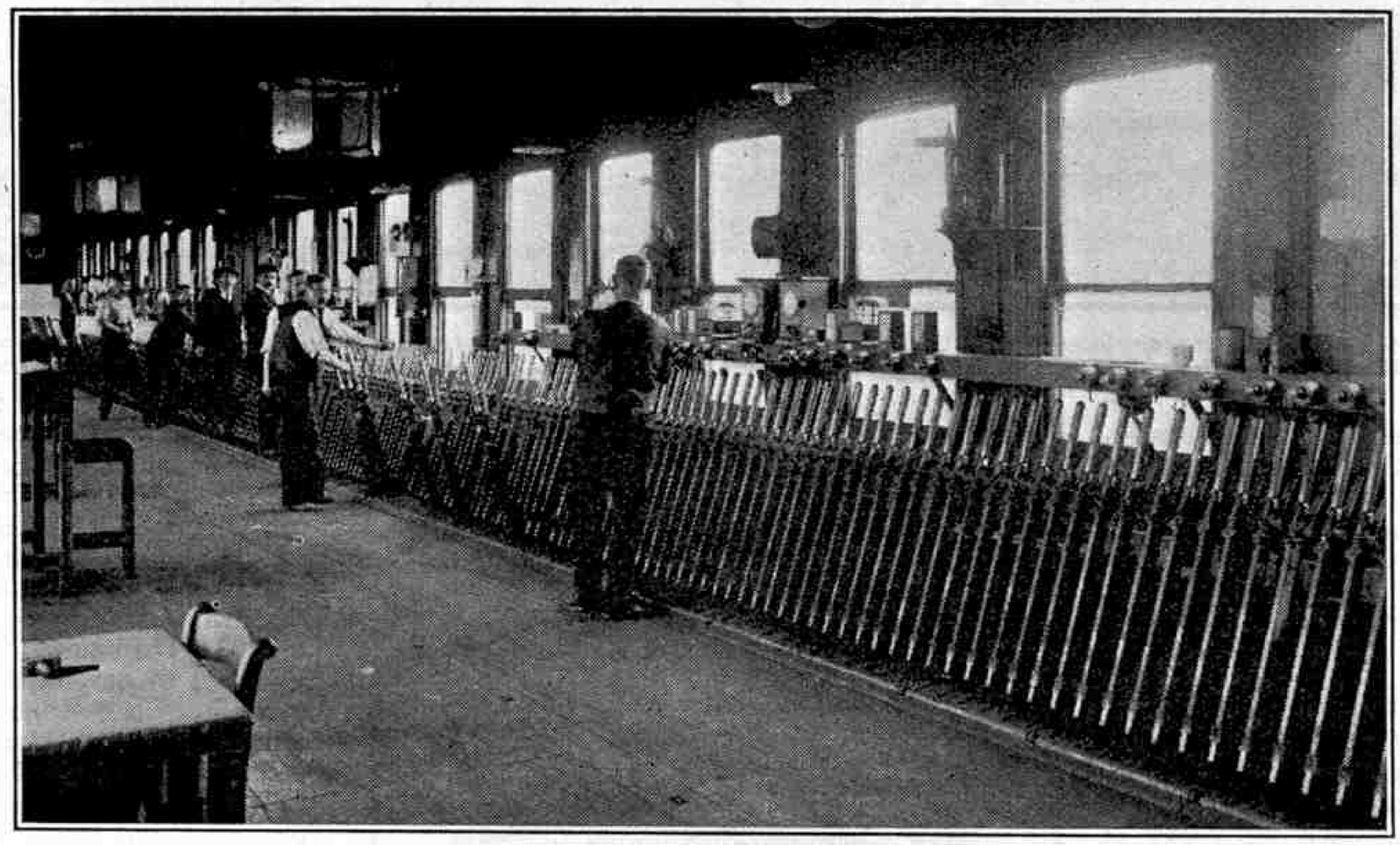
The Canadian National Railways have acquired 500 freight wagons, capable of carrying 70-ton loads. These are known as composite drop end gondola cars and are made of steel and wood. Their unloaded weight is 25 tons and they have a capacity of 2,440 cu. ft. They are 48½ ft. in length, 9 ft. 4½ in. in width, and 4 ft. 6⅛ in. in height inside. A bottom dumping arrangement makes them suitable for the carriage of coal, sand, gravel and other loose materials, while their length enables them to be used for the transportation of steel sections, bridge girders, rails, poles and similar goods. The cars are equipped with air brakes.

Development of Railway Signalling

II.—Semaphore, Automatic and Colour-light Systems

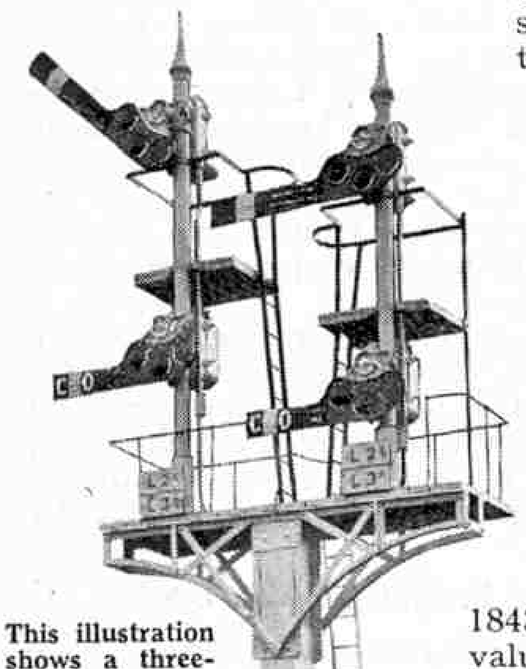
LAST month we dealt with the elementary principles of signalling, the uses of various semaphore signals and the instruments that are used for communication between signalmen. This month we intend to trace the growth of the semaphore system with mechanical interlocking and the more recent developments in colour-light signalling and automatictrain control.

The first semaphore signal is said to have been erected by Sir C. H. Gregory in 1841 at New Cross on the London and Croydon Railway. This signal consisted of a wooden post with a slot at the upper end in which were pivoted two arms, one to control each line of track. Each arm was attached by a rope to a pulley operated by a lever attached to its axle. When the arm was horizontal it indicated "danger"; when inclined downward at an angle of 45 degrees, "caution"; and when allowed to fall down and disappear in the slot of the post, "line clear."

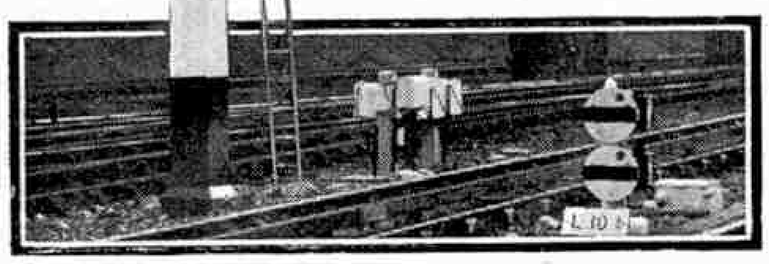


Large signal boxes such as those at busy junctions contain a great many levers. The greatest number of manually operated levers is at York on the L.N.E.R. where 295 levers are installed in the Locomotive Yard Box.

For a long time all signals were operated by levers fixed to the signal post itself, which necessitated having men stationed at the foot of the posts, each man having one or two posts under his control. As traffic increased, however, it was found very inconvenient for the signalman to have to walk to each signal when it became necessary to move the arm.



This illustration shows a three-position upper-quadrant bracket signal while that opposite is of a three-phase colour-light signal.



Sir C. H. Gregory followed up his invention of the semaphore signal by producing the first machine for operating several signals and points from one place. In 1843 he demonstrated the practical value of his invention by working the signals and points at the Bricklayers' Arms junction on the Croydon Railway from one frame of levers. The signals were connected to the levers in the frame by means of chains passing round pulleys. The levers were provided also with an attachment that made it impossible to lower two signals at the same time when these signals would be for trains crossing or otherwise fouling one another.

Gregory's frame, while preventing conflicting signals from being lowered, did nothing to ensure the points being set before the signals were pulled to the "line clear" position. It soon became apparent that in order to ensure safety at junctions it was essential that the signals and points should be so interlocked as to make conflicting settings impossible.

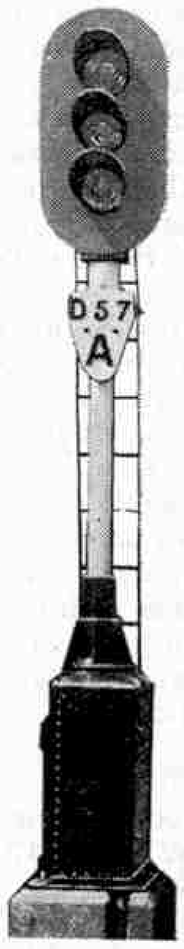
The first attempt to provide a lever frame to supply this need was made in 1856 by J. Saxby, who connected the point and signal levers to work together. This method did not prove satisfactory, however, and it was left to A. Chambers to produce in 1860 the first frame on the modern system, in which the levers moved independently but the movement of one point or signal lever locked all other conflicting levers. This frame also required that the points should be set before the corresponding signal could be lowered. This system was first installed at Kentish Town Junction Cabin on the North London Railway. Ten years later Messrs. J. J., J. J. F., and W. A. Stevens patented a locking mechanism employing tappets, a system that has remained in use until the present time and which has practically superseded all others.

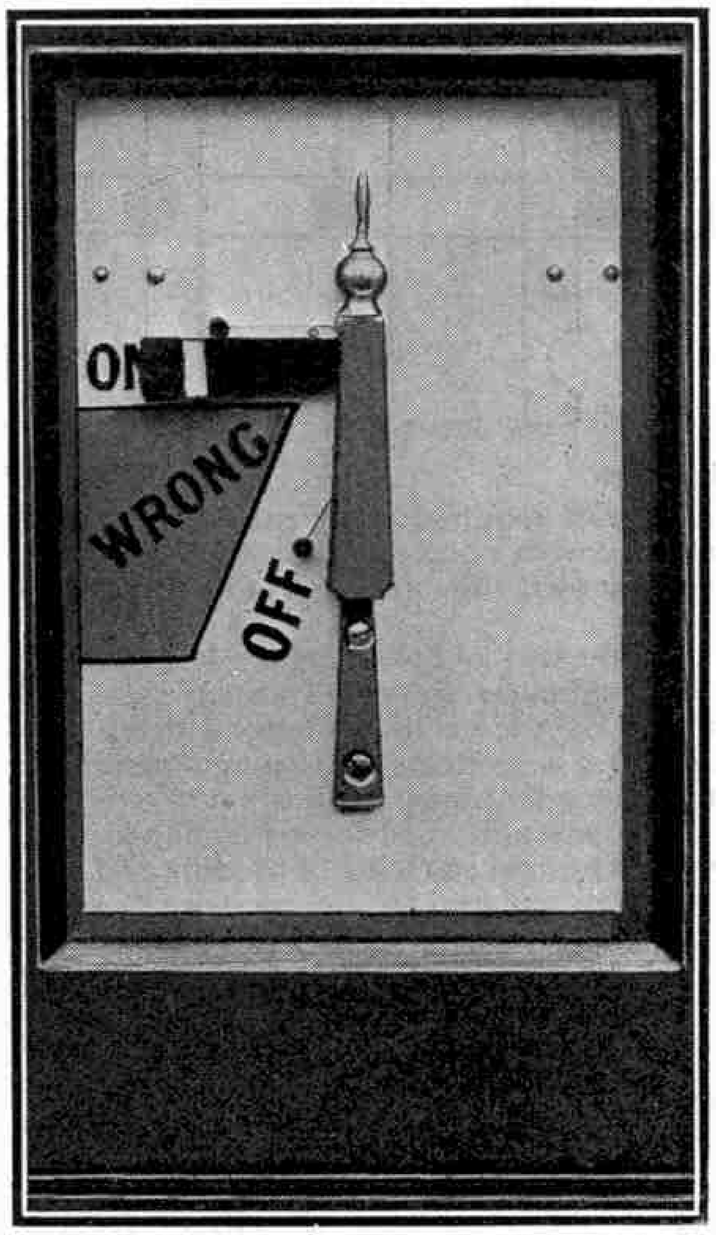
The actual mechanism of an interlocking frame is very complicated and a detailed description of it is beyond the scope of this article. A good idea of the principle upon which the mechanism operates may be obtained, however, without going into detail.

Before dealing with the locking mechanism itself we must pause for a moment to consider points or switches and their uses. Points provide the means whereby a train may be made to travel from one line to another. They consist of two movable rails called "switch-tongues," placed on the inner side of running or "stock" rails which do not move. The "switch-tongues" are worked from side to side by a rod operated by a lever and cranks to which it is connected by a series of iron rods known as "point rodding."

The iron rodding between the points and the signal box undergoes expansion or contraction with different changes in temperature, and in order to prevent this causing uncertainty in working, what is known as a "compensator" is provided. This device consists of two crank arms connected with the rodding about half way between the points and the signal box. Any movement of the rodding due to expansion or contraction moves the crank arms closer together or further apart and thus compensates for the greater or smaller length of the rodding.

The tip of the switch-tongues is called the "toe" of the points and the other end the "heel." When the "toe" faces a train in the running direction the points





An electric "repeater" instrument. Its function is to reproduce the indication given by a signal that cannot be seen from the box.

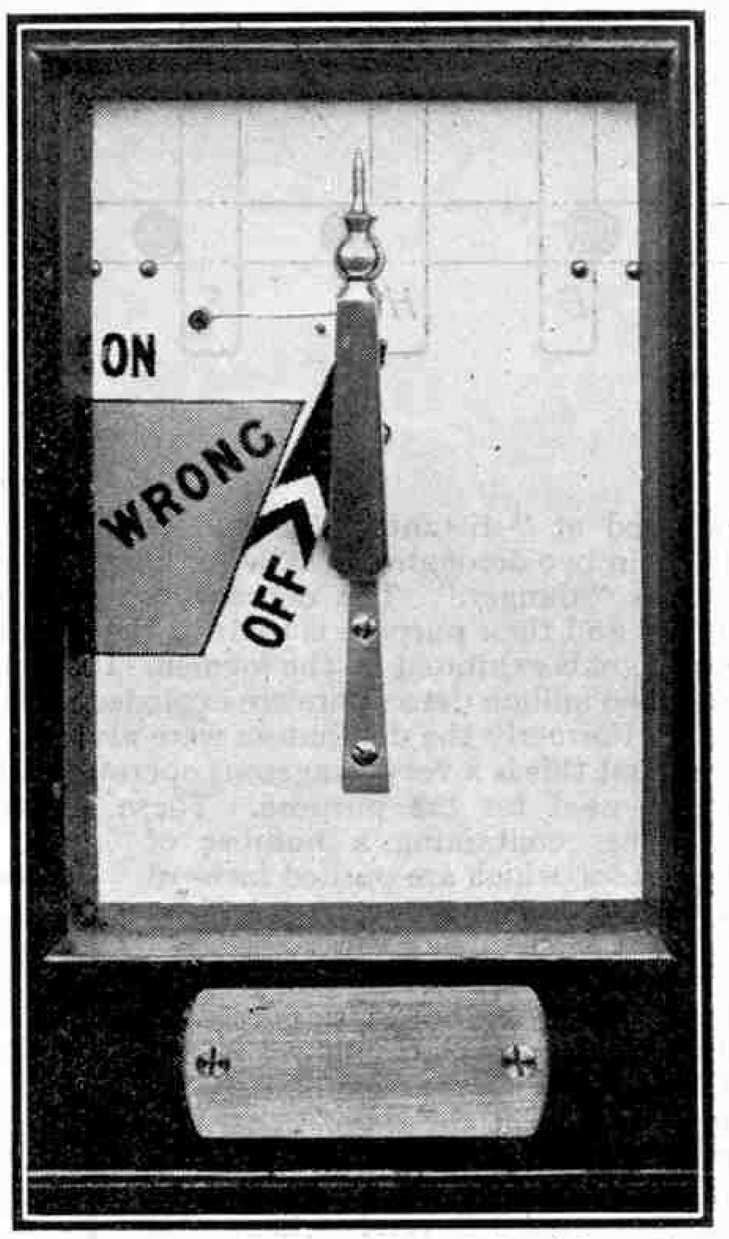
are called "facing points"; points lying in the other direction, so that a train passes the "heel" first, are called "trailing points." One of our illustrations, Fig. 2, shows "trailing points" at A and "facing points" at B, with check rails at C. Check or guard rails are rails laid along the inner side of the inside rail at a curve, or opposite to points, and their function is to prevent any possibility of the flanges of the wheels mounting the rail.

Generally speaking, "trailing points" are used wherever possible in making crossings from main lines on account of their safety in the event of incorrect setting. In order that a train shall pass safely over points it is essential that the tip or "toe" of one of the switch-tongues shall be against the stock rail, so that the wheel flanges cannot pass between the two. In the case of facing points, failure to set the switch-tongue correctly would most probably result in derailment of the train, because the wheel flanges would either get between the toe of the switch-tongue and the stock rail, or strike and mount the toe. With trailing points derailment would not follow incorrect setting, however, because the locomotive wheels would force the switch-tongues out of the way, and the train would pass on in safety.

At facing points on all passenger lines it is compulsory to fit special safety appliances—facing point locks, locking bars and detectors. The facing point lock prevents the points from being moved from the signal box or by accident while the lock bolt is in the bolted position, and it also makes certain that the point blades are pressed tightly against the stock rail, even in the event of the point rodding becoming damaged or disconnected. The locking bar prevents a signalman from unbolting the facing points while a train is running over them or standing on them. The detector ensures that the points are placed in the correct position before the signal applying to them can be pulled to "all right."

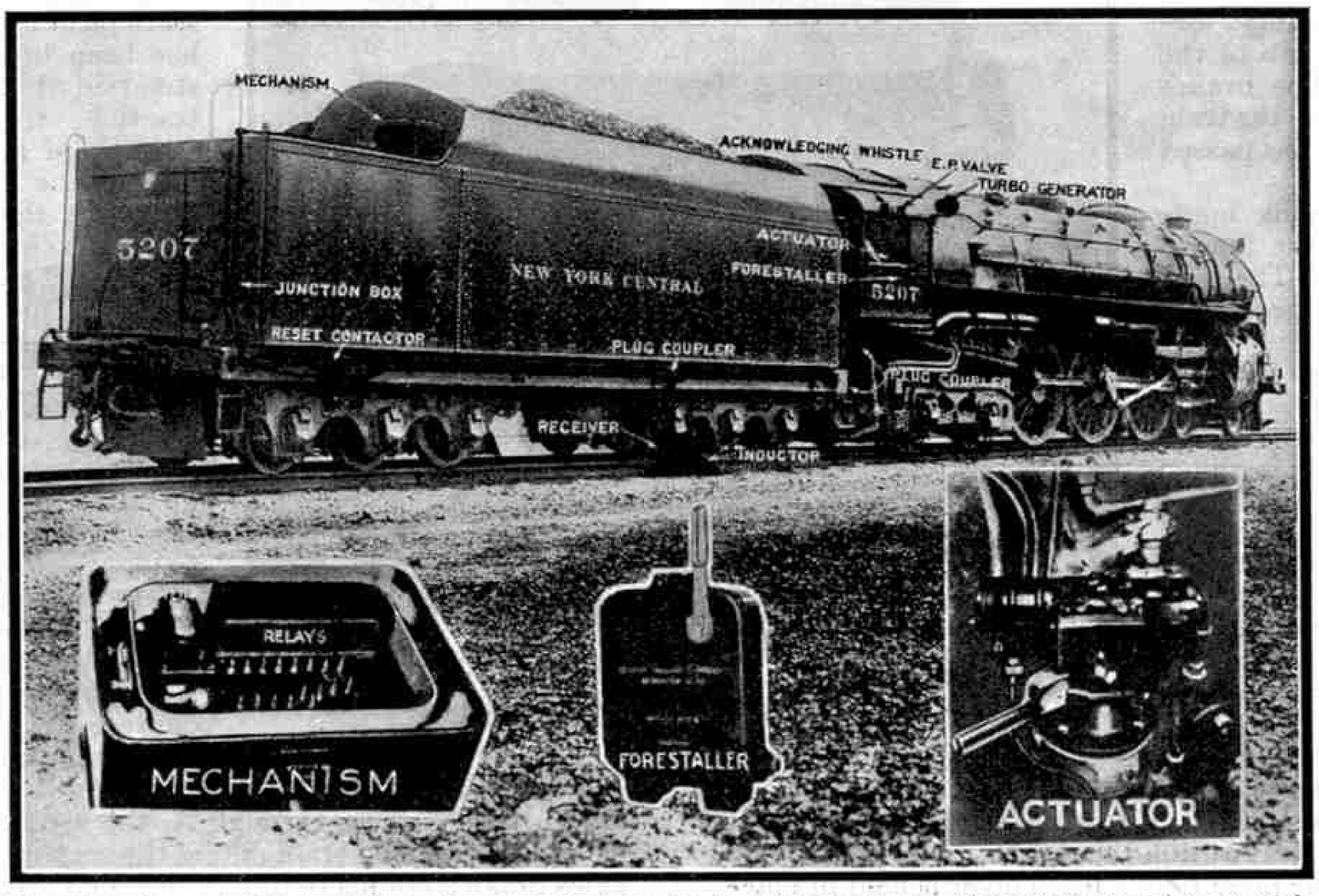
Interlocking may be defined as arranging the operation of the levers in the signal box in such a manner that they permit one another's movements in carrying out correct setting of points and signals, but obstruct one another so as to prevent wrong settings. In order to guard effectually against mistakes on the part of a signalman, signals must be interlocked so that "distant" signals cannot be lowered until the "home" and "starting" signals have been placed in the "all right" position. Similarly, points connected with the running lines must be correctly set before the "home" or "starting" signals can be lowered.

In an interlocking frame the movement of a signal or points lever moves a "tappet" or sliding bar of metal to which it is attached. This in turn moves appropriate "dogs" that engage in notches in the "tappets" belonging to the particular points and signal levers that the movement of the first lever necessitates should be locked. The locked signals remain locked until the first lever is returned to its original position. This method of interlocking also makes it necessary for the levers to be set and returned in the proper order. For example, the points must be set before the signals are lowered, and conversely the signals must be returned to "danger" before the points levers become unlocked.



A "repeater" instrument in the "off" position. From this the signalman knows that the signal is showing "line clear" and that everything is working properly.

The operations involved in interlocking will be made clear by a few minutes' study of the accompanying diagram, Fig. 1, which represents the locking and back-locking that takes place between the "distant," "home" and "starting" signals at a small wayside station. The left diagram shows the state of affairs when the "distant," "home" and "starting" signals are all at "danger." The "distant" signal is now held by the "home" and "starting" signals. While this position remains it is impossible for the signalman to move the "distant" signal. The middle diagram shows the position after the "home" and "starting" signal levers have been pulled to the "all right" position. The "distant" signal is now free and may also be lowered to "all right." In the right diagram the "distant" signal lever has been pulled and the lock bar carried to the left. The "home" and "starting" levers are now locked by the "distant" lever, all three now being in the "off" position. As matters now stand the "distant" signal must first be restored to "danger" before the other levers can be moved.



The automatic control equipment of a New York Central "Hudson" locomotive. This allows the driver to retain the control of the train so long as he observes the signal indications, but takes the control away from him on the side of safety if he disregards them.

Signalling by semaphore is all that can be desired in fine weather, but during fog or snow storms, when drivers cannot see the signals in time to act upon them, special arrangements are necessary to ensure the safety of trains. Fog signalmen, provided with flags or lamps, and detonators—familiarly known as fog signals—are

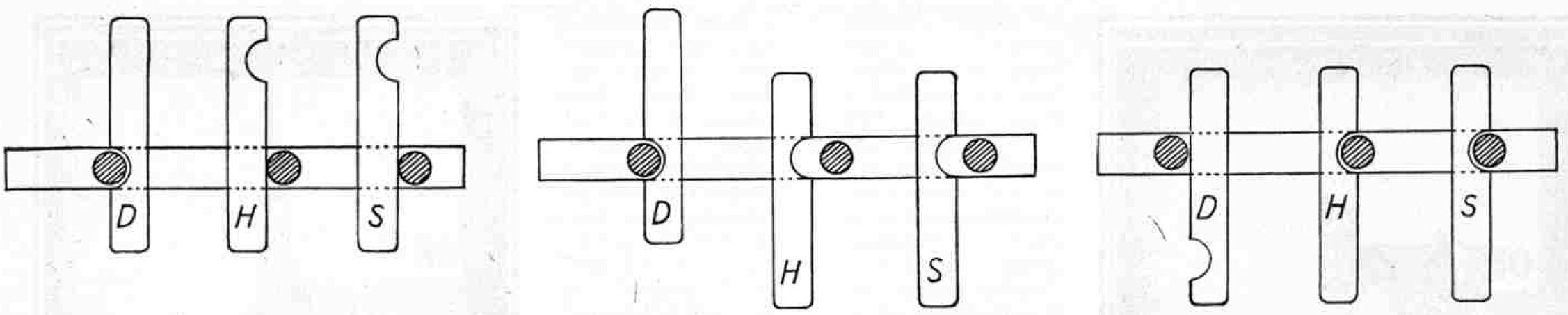
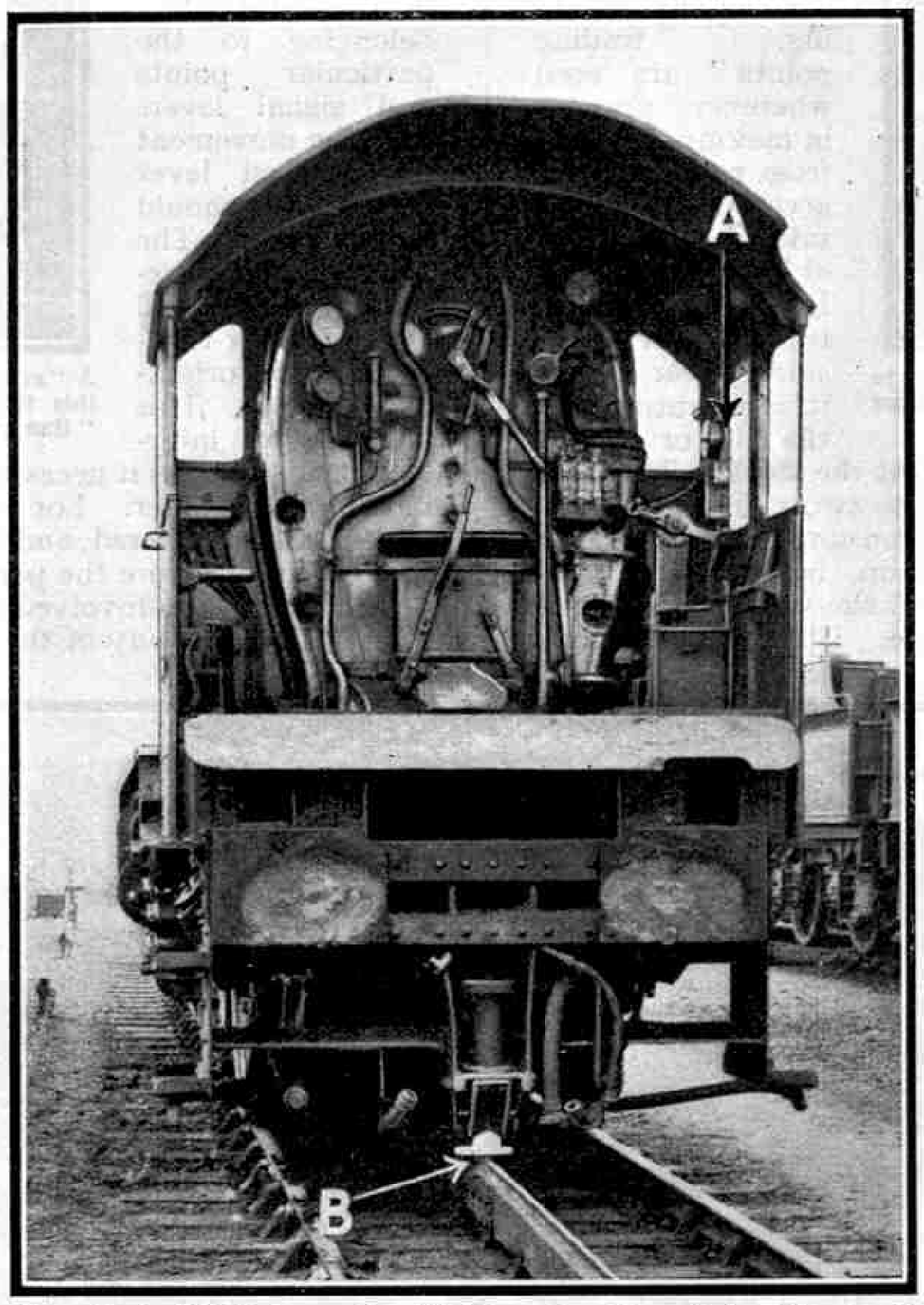


Fig. 1. Diagram showing the interlocking arrangements referred to in this article.

stationed at "distant" signals. The task of the fogmen is to maintain two detonators a little to the rear of each signal so long as it is at "danger." The detonators are exploded by oncoming engines and their purpose is to draw the attention of drivers to the hand signals exhibited by the fogmen. It is interesting to note that some two million detonators are exploded on British railways every year. Formerly the detonators were always placed on the line by hand, but this is a very dangerous operation, and machines are now largely used for the purpose. These machines are fitted with magazines containing a number of detonators, which are pushed forward on to the running rails as required by the operation of a lever.

Various mechanisms have been devised with the object of giving an audible warning to the driver in his cab when he is approaching a "distant" signal in the "on" position, and automatically applying the brakes in the event of this warning being ignored. Several schemes of this kind have been devised and tried but the only one used at all extensively in Great Britain is the system developed on the G.W.R. This is now in use over some 2,310 miles of their main line routes. By means of a fixed ramp laid between the rails, a contact shoe on the engine, an electrically controlled brake valve and siren combined, and an electric bell, distinct audible warnings are given to the driver in the cab of the position of the signals. The brakes are automatically applied and the train is stopped should a signal be passed in the danger position.

Experiments are also being made with inductive control on the Southern and L.M.S. railways. The system known as the Strowger-Hudd so far has given very satisfactory results. A hooter warning is given to the driver at the approach to a distant signal; should this be at danger, a further warning is given and an application of the brakes follows. If there is no warning, the driver knows that the distant signal shows "all clear."



The cab of a G.W.R. locomotive fitted for automatic control. The electric bell apparatus is shown at A, and at B the special shoe on the engine is seen making contact with the ramp between the running rails. A total main line mileage of 2,310 is now equipped for this system as are all the later patterns of G.W.R. locomotives.

Almost everybody is familiar with the appearance of a signal box with its long row of levers by means of which the points and signals are operated through the medium of connecting wires and iron rodding. The levers are placed in a frame in which they can be pulled forward or pushed backward. The backward position is the normal one, and when the levers are in this position the signals are at "danger" and the points are set for the main line. Each lever is held in place by a catch which is released by pressing a handle when the lever is moved.

In order to assist the signalman in rapidly picking out individual levers these are painted in distinctive colours. The arrangement varies somewhat on different lines, but the usual lever colours are green for "distant" signals and red for other signals; black for points or switches; blue for facing point locking bars and bolts, and white for spare levers. In addition to this distinctive colouring the levers carry plates bearing numbers, or alternatively have the numbers painted on their sides. These are known as "releasing" numbers, and are arranged in the order in which each lever must be pulled before a certain required lever can be operated. Each signal box is also provided with a diagram showing the position of all signals and points together with the numbers of the operating levers.

In many large signal boxes the task of operating the levers is now carried out by electric or pneumatic power. In such cases the signalman has only to move a lever a few inches long, which brings into action the mechanical power and effects the required operation. Power signalling has many other advantages in addition to relieving the strain upon the signalman's arms. The long stretches of rodding and wire are replaced by electric wire or small tubes which, as they have no moving parts, can be covered in in any way desired or even carried underground. Another gain is that corners and curves can be negotiated with the greatest ease and without the addition of complications such as arise with rodding or wire.

The enormous growth of railway traffic during recent years has made it necessary to speed-up the movement of trains while still keeping within safe limits. On certain sections of various lines the ordinary method of signalling by means of box-to-box communication does not allow a sufficient number of trains to be passed through during the rush hours of the day. In many cases on such sections of line the necessary speed-up has been brought about by the substitution of electric traction for steam traction, together with the introduction of automatic signalling.

For the purpose of automatic signalling the line is divided into sections, each of which is "track-circuited" and controls an automatic signal. The rails are insulated and are made electrically continuous by means of "bonding" wires, which join the end of one rail to the end of the next. At one end of the section the two running rails are connected up to a "track-circuit relay," which is really the signal controlling apparatus.

The necessary electric current is applied at the other end of the section and before reaching the rails it passes through an "impedance" which controls its flow. The current then flows along one running rail and through the relay and returns by way of the other running rail. So long as the relay is energised by the current passing through it, the signal is held at the "clear" position. When a train enters the section, however, its wheels and axles make a connection between the two running rails, and as this path offers less resistance from the relay, most of the current passes through it. Thus the relay no longer receives sufficient current to keep it energised and therefore its contacts open, moving the signal to "danger." As soon as a train passes out of the section the relay again receives its full amount of current and moves the signal to "clear," ready for the next train.

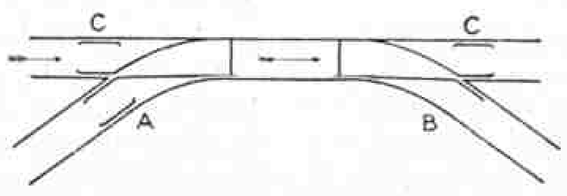


Fig. 2. Trailing and facing points.

Two main types of automatic signal are now in use, the "semaphore" and the "colour-light." The former type was introduced by the London & South Western Railway in 1902 and a section of line at Grately was equipped with automatic signals of the "lower-quadrant" type, in which the signal arms are horizontal for "danger" and drop

45 degrees to show "clear."

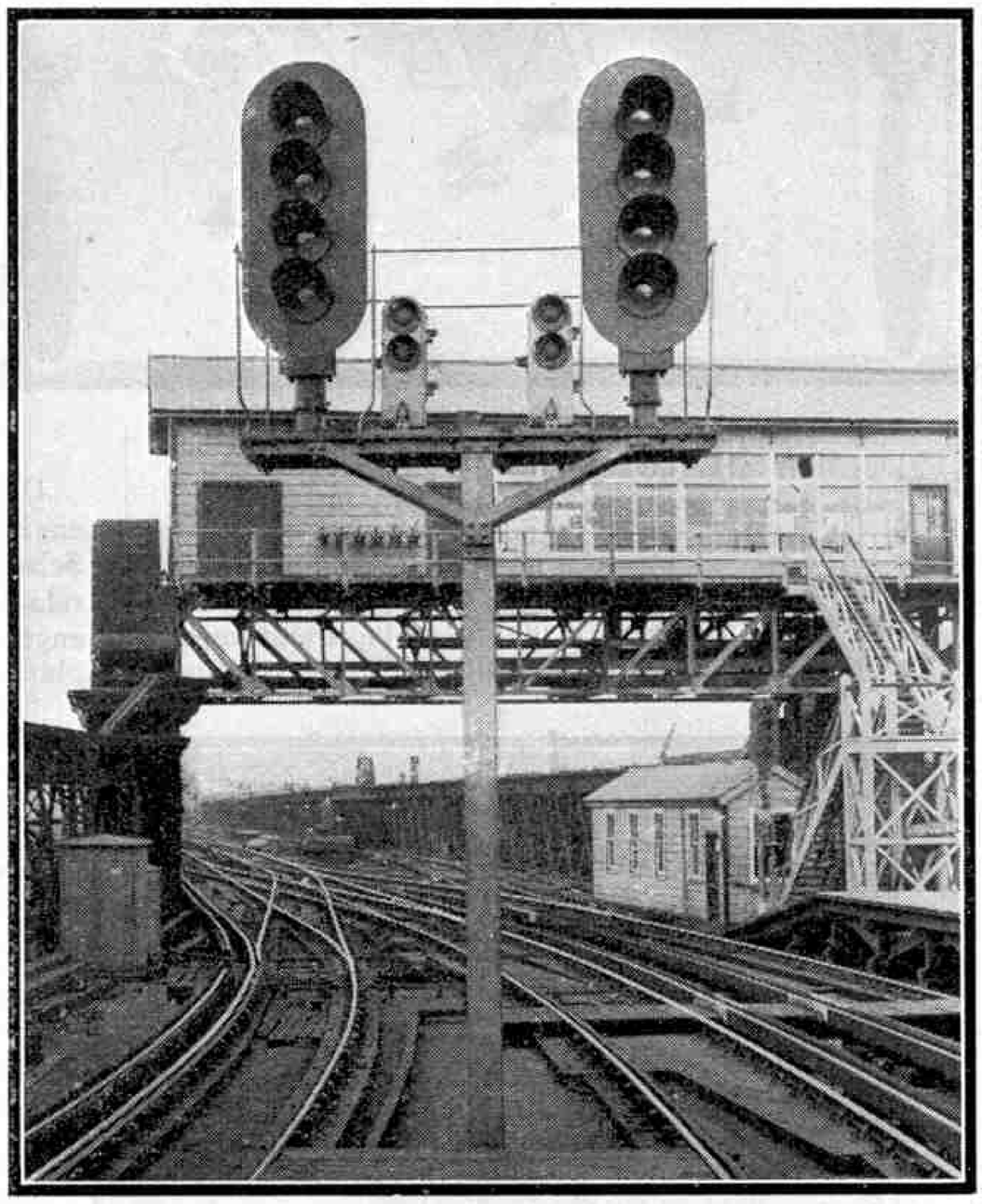
In 1909 the Metropolitan Railway introduced the "upper quadrant" type of signal, the first being installed at Aldgate. In this type the signal arm points upward at an angle of 45 degrees to indicate "clear," so that in the event of any failure of the apparatus the arm would immediately drop to a horizontal position, thus signifying "danger." The "upper quadrant" signal gives a much clearer indication to the driver than the "lower quadrant" type. As a result it is being installed to a considerable extent in place of the ordinary pattern.

Colour-light signals were used at first only in tunnels and other places where daylight does not penetrate, but they are now rapidly coming into use for daylight signalling also. At first sight it would appear as though light signals would be useless, or at any rate very inefficient, in daylight, but as a matter of fact, if the lamps are shaded, the light is visible at a great distance even in strong sunlight. The latest colour-light signals on the Metropolitan Railway are visible at 1,000 yards in daylight and at a still greater distance at night. The lamp consists of an iron case with red and green lenses and sometimes also a yellow lens. Behind these lenses are the lamps proper. If a train were to attempt to pass a "stop" signal at "danger" it would be pulled up automatically by means of a trip catch by the side of the line striking a trigger on the train and thus actuating the braking apparatus.

On some lines a three-aspect colour-light is installed, the third-aspect showing whether the next signal is at "clear" or "danger." An even later development is four-aspect signalling, which is installed on certain sections of the Southern Railway. The indications are as follows:—Red, "Danger, Stop"; Yellow, "Caution, next signal shows 'danger'"; Double Yellow, "Warning, next signal shows 'Caution'"; and Green indicating that the track is clear for at least two sections ahead. With this system red is always used as an absolute "stop" signal. The two cautionary signals give the drivers of fast trains ample warning before they reach a "stop" signal, and the double warning not only does away with the risk of over-running a signal exhibiting a red light but also gives a driver more confidence when running at high speed.

An interesting feature of these lights is the addition of a secondary beam at an angle to the main beam and known as a "side light." The light from the lamp, being placed in the focus of a lens, travels outward as a beam of almost parallel rays, and this beam cannot be seen by a driver who is quite close to the post. The "side light," however, comes into the driver's line of vision at the same moment that the main beam passes out of it, and so the signal aspect is always in view even when the driver is by the side of the post.

It is interesting to know also that in a yellow fog of quite considerable density the lights are capable of penetrating some 200 yds., and in this respect they are greatly superior to the semaphore type. In an extremely dense fog the light probably would not penetrate more than 30 or 40 yds., but in such weather conditions drivers would normally be proceeding at reduced speed and the two warnings received before arriving at a "stop" signal would be amply sufficient to prevent over-running. Other advantages of colour-light signals are that they have no moving parts and that the signal indication is always exactly the same whether by day or by night.



A colour-light signal at Charing Cross of the four-aspect pattern as developed and extensively applied on the Southern Railway. The larger "dolls" govern main line movements, but the two-aspect dwarf signals are for shunting only.

With these and other improvements in automatic train control it is possible to secure the most intensive train service not only without any increase in danger, but actually with a decrease, owing to the elimination of the human factor.

With this last object in view a very interesting system was introduced some time ago on the steam operated section of the New York Central Lines. This operates in conjunction with the track-circuiting arrangements of the automatic signalling system. An inductor is located alongside the running rail but no electric current is supplied to it. The control circuits of the automatic signalling system set up a choking effect in the inductor circuit, which is broken when the signal displays any indication other than "clear." The condition thus set up on the lineside is transmitted to the train by means of a receiver on the locomotive.

One of the accompanying illustrations shows the general arrangement of the train-stop equipment on the locomotive. The turbo-generator situated in front of the engine cab supplies the electric current to operate the train-stop device, in addition to the headlight and the engine lights. The mechanism case which is at the rear of the tender contains automatic train-stop relays. If the locomotive passes over an inductor when the signal gives any other indication than "clear," the relay armatures are opened and a full brake application automatically follows the opening of an electro-pneumatic valve. The circuits cannot be restored until after the train has come to a complete stop. This restoration is effected by pressing a button on the re-set contactor placed at the rear of the tender frame. The automatic application of the brakes may be avoided by the driver operating an acknowledger handle which shows that he has seen the signal. He is informed that the inductor has been passed by the sounding of an acknowledging whistle, so that he may then release the handle. The latter, incidentally, if held longer than 15 seconds automatically applies the brakes so that this system ensures safety under all conditions.

A South African Reserve—(*Cont. from page 919*)

and it is obvious that it is the sickly, the less alert and intelligent, as well as the less active and older individuals, that most readily fall victims. Carnivorous creatures are in fact Nature's own way of maintaining an equable balance, checking undue increase, and keeping the herbivorous species healthy and active by the constant destruction of the unfit. In their own case the same principle holds good, for those that are unable for one reason or another to capture their swift and wary prey cannot survive in the struggle for existence. Both vegetarian and flesh-eating animals are dependent upon the amount of their food supply, and their numbers are strictly regulated by the supply available in each case. It is at times of scarcity of food that the larger carnivora become a danger to the domestic animals of man. In the ordinary way lions, for instance, are only too willing to give man and his belongings a wide berth. When urged by hunger, however, they become bold, and an individual that has once erred with impunity, and found it easier to catch domestic animals than wild game, is apt to repeat the practice until it is destroyed.

Up to a few years ago the areas surrounding the game reserve on all sides were well stocked with game, and contained a very small number of white settlers. Since the opening up of the low veldt has commenced, the game animals in the settled areas have greatly diminished, and in consequence the lions native to those areas have become a nuisance. It seems likely that, with the complete elimination of the game outside, all large carnivora will tend to disappear into the game reserve, where they can find abundant food.

Surprising statements have appeared in the public press during the past two or three years regarding the number of lions supposed to exist in the game reserve. Figures varying from 1,000 to 10,000 have been freely quoted. Careful investigation and calculation show that actually the total number of adult lions existing in the reserve at the present time does not exceed 600.

The reserve is a wonderful natural reservoir for all bird life. Birds of prey are of great value in keeping in check poisonous snakes and the smaller rodents, and storks, egrets and buffalo weaver birds keep down noxious insects.

Air Ministry Mailplane

On page 276 of our issue for April 1932 we gave brief details of a mailplane that was being constructed for the Air Ministry by Boulton & Paul Ltd. Further details of this interesting machine are now available, and it is hoped that a fully illustrated description will be published in an early issue of the *"M.M."* As previously mentioned, the Boulton and Paul mail carrier, officially known as the P.64, is a twin-engined biplane, similar in external design to the Boulton and Paul "Sidestrand," illustrated and described on page 796 of our issue for October 1931. The mail carrier was selected from about 20 competing designs that were submitted to the Air Ministry by other British aviation firms.

Close attention has been paid to the streamlining of the machine in order to obtain a high maximum speed with the minimum expenditure of power. This effect has been enhanced by placing the engines in the wings and by providing streamlined fairings for the wheels. None of the struts and axle rods usually found on undercarriages are to be seen on the Boulton and Paul machine. Actually, this form of undercarriage was only decided upon after numerous tests had been carried out. It was at first thought that a retractable undercarriage would be the best type, but it was found that the carefully streamlined fixed undercarriage only reduced the maximum speed by two or three m.p.h. The extra weight that would have been added to the machine by a retractable undercarriage, would have reduced the speed by more than this; while fixed undercarriages are of course far more reliable than the other type.

The Boulton and Paul machine is capable of carrying a crew of three, together with a large load of mails or freight. It is fitted with two Bristol "Pegasus" engines, similar to the type illustrated on page 939 of this issue. These develop 555 b.h.p. at 4,500 ft., and are of the nine-cylinder radial air-cooled type. The wings of the P.64 have a span of 54 ft., while the machine is 42 ft. 6 in. and 13 ft. in overall length and height respectively. When empty it is 6,125 lb. in weight. It is capable of carrying a load of 4,375 lb. and thus has an all-up weight of 10,500 lb.

When operating as a landplane the estimated maximum speed at 5,000 ft. is 195 m.p.h., while the cruising speed at two-thirds maximum power is 172 m.p.h. The aeroplane lands at 60 m.p.h., is capable of climbing at a speed of 1,400 ft. per minute at an altitude of 4,500 ft., and has an absolute ceiling of 25,000 ft. When carrying a crew of three and a full load, the machine is capable of cruising for 1,250 miles at 172 m.p.h. If one engine should fail, the other provides sufficient power for a height of 5,000 ft. to be maintained. As this engine would still be running at less than its rated output, there would be no danger of the added load causing it also to fail.

It is interesting to note that the mail-plane may be provided with floats in order to enable it to operate from water. It then has a maximum speed at 5,000 ft. of 182 m.p.h., and a cruising speed of 160 m.p.h. at two-thirds maximum power. The rate of climb at 4,500 ft. drops to 1,000 ft. per minute, and the absolute ceiling to 22,500 ft. The maximum range with normal tanks is 1,100 miles. The seaplane version has an all-up weight of 11,550 lb., and is still capable of maintaining an altitude of 5,000 ft. with only one engine in action. This still runs well below its rated output.

A Canadian Airways Ltd. air engineer dressed for work in the cool weather, just previous to the freeze-up! Photograph by courtesy of Canadian Airways Ltd.

Fiat Racing Engine

Details of the Fiat A.S.6 racing aero engine that was produced for the 1931 Schneider Trophy Contest have been released by the Italian Air Ministry. The engine was installed in the Macchi monoplanes that also were designed for the Contest, but were not finished in time. One of these machines is claimed to have attained a speed of 422 m.p.h. at Desenzano, where flights have been made recently by the Italian High Speed Flight.

The new Fiat engine is different in general appearance from anything previously produced by the Fiat Company, for it is made up of two 12-cylinder Vee engines placed end to end. The engine is provided with an aluminium crankcase that runs the whole of its length, while in the middle there is an auxiliary double gear-case. Another unusual feature of the engine is the way in which the power is taken from it. The central gear-box is provided with spur reduction gears for each of the 12-cylinder units, and the airscrew drive of each unit is independent, although they are co-axial. The two crankshafts revolve in different directions, but gears are provided in order to ensure that they both rotate at equal speeds. The two propeller shafts are carried one within the other, and at the front are each provided with a separate hub. These hubs also are co-axial, and rotate in opposite directions. The mixture is fed through a tubular manifold carried in the "V" of the cylinder units. It is first passed through a special carburetter and a large supercharger.

The Fiat A.S.6 racing engine is capable of developing about 2,800 h.p at 3,200 r.p.m., and has a dry weight of about 2,050 lb.

First Aeroplane Built in South Africa

A small aeroplane recently built at Somerset East is claimed to be the first aeroplane designed and constructed in South Africa. The machine is a single-seater parasol monoplane and is fitted with a 35 h.p. four-cylinder horizontally-opposed air-cooled engine. It is said to be capable of a maximum speed of 100 m.p.h., and of a cruising speed of from 70 m.p.h. to 80 m.p.h. The landing speed is between 30 m.p.h. and 35 m.p.h., and about 70 miles may be covered on a gallon of fuel.

The aeroplane only took nine months to build and its total cost was £400. It has been flown a number of times, and on one occasion a height of 8,000 ft. was attained.

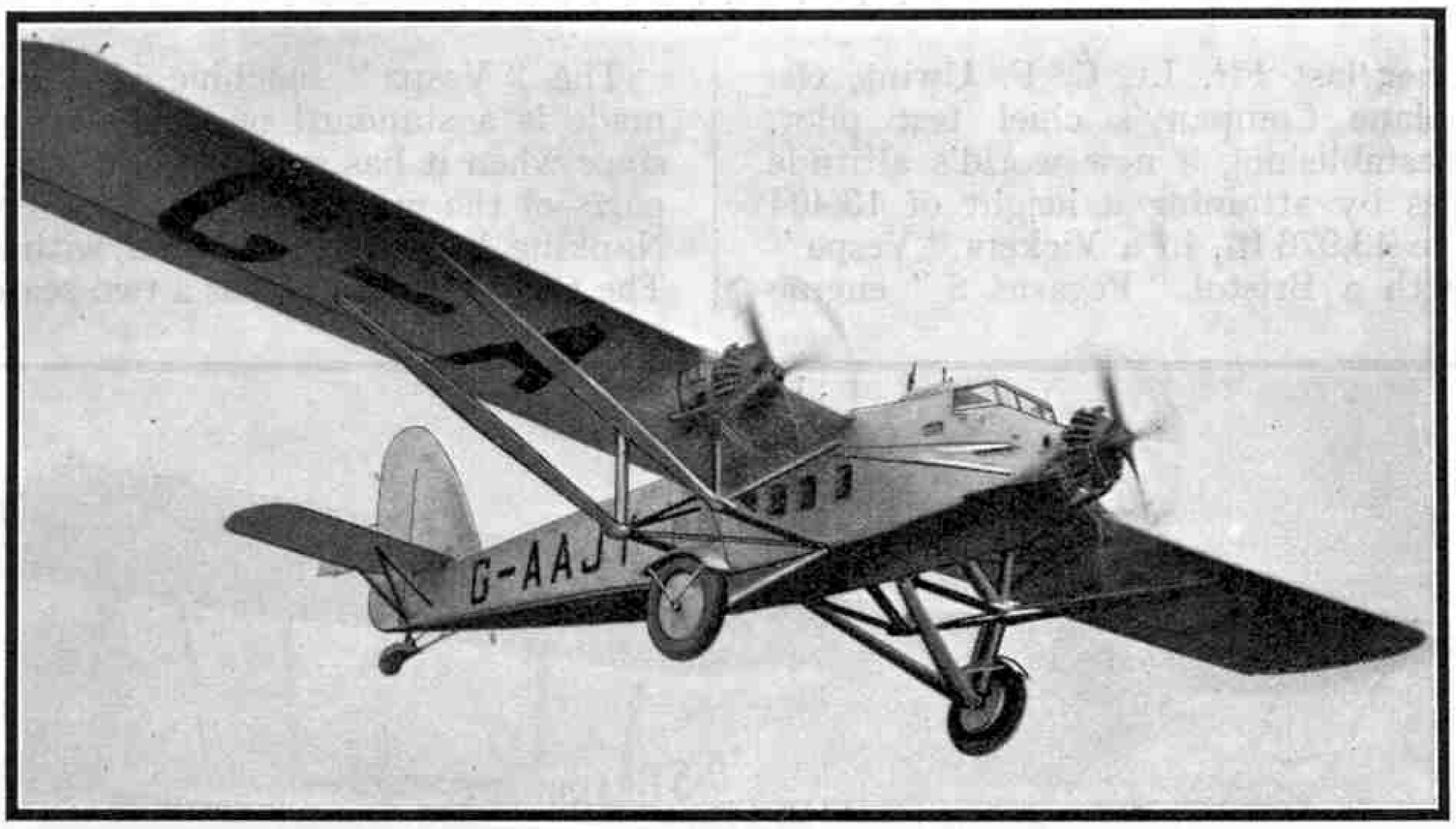
African Air Mail News

It is interesting to note that the inward air mail from Africa is now heavier, each week, than the out-going mail from England. According to statistics made available by Imperial Airways Ltd., approximately 14,000 letters a week are now reaching London by the inward mails, while the out-going mail amounts, on an average, to about 12,000 letters a week. In the earlier stages of this service, not very long ago, the mail loads on the service outward from this country were by far the heavier.

One of the difficulties of operating on an all-the-year round basis an air mail service such as the Imperial Airways trans-African route is the deterioration of aerodrome surfaces during spells of rainy weather. Periods of prolonged and heavy rain may make it almost impossible for an aeroplane to take off or taxi, and thus it is often essential to prepare special runways in order to ensure a sufficiently firm surface, irrespective of the softness of other portions of the aerodrome.

Local soils vary considerably in different areas, and a great deal of test work has had to be carried out to determine the best and least costly method of treating strips of ground to provide surfaces which, even under the worst conditions, will bear the weight of large aircraft without any risk of wheels sinking in or of machines becoming bogged.

Tests that are typical of the experiments now in progress have been conducted recently at Malakal Aerodrome, in the Sudan. Top layers of soil from this aerodrome have been removed and treated with various ingredients in order to produce a mixture which, when rolled in strips to form runways, will not become too soft, even after continuous rain. As a result of these tests, a satisfactory method has been evolved. This consists of first pulverising the soil and then mixing it with asphalt in concrete-mixers, a suitable solvent being employed. The resulting substance is then put down in layers and rolled. It does not set entirely hard, but when cut up, by a tail skid for instance, it can quickly be rolled out smooth again. At the same time it is found that the surface, though remaining to a certain extent plastic, can be relied upon to stand up to the weight of aircraft when machines are taking off, landing or taxying. The merits of this method of producing a runway are simplicity and cheapness, and the fact that as it may be adapted to varying conditions, it is capable of being employed in different localities.



The Short " Valetta " as a landplane. The seaplane version of this, which is the largest seaplane in the world, was illustrated and described on page 940 of our issue for December 1930. Photograph by courtesy of Short Bros. (Rochester and Bedford) Ltd.

World's Landplane Speed Record

Mr. James Doolittle, the famous American pilot, has succeeded in setting up what is claimed to be a new world's speed record for landplanes. The attempt on the record was made at Cleveland, Mr. Doolittle maintaining a speed of 296.287 m.p.h. over a specially prepared 3-km. course in a Gee Bee racing monoplane. This exceeds by more than 14.7 m.p.h. the previous record, set up in 1924 by the late Adjutant Bonnet.

The machine on which Mr. Dolittle set up the record is very unusual in appearance. It is of the low wing type, and, although not very long, the fuselage is comparatively thick. A particularly unusual feature is that the pilot is carried immediately in front of the tail unit, the rear of the cockpit being almost directly above the leading edge of the tailplane. The machine is well streamlined, and in fact might almost be described as a " flying bullet," particularly when seen from the side as it is speeding through the air. The whole of the undercarriage unit is completely faired in. The aeroplane was fitted with a Pratt and Whitney " Wasp " engine of the supercharged type, that develops approximately 800 h.p. During the attempt it was used in conjunction with a variable pitch airscrew.

Aviation enthusiasts admiring a scale model of an aeroplane at a model aero show.

The Bibesco Challenge Cup

An International Challenge Cup has been presented by Prince Bibesco, who is President of the Fédération Aéronautique Internationale, for a " round-the-world " contest. This contest is open to all aircraft, no distinction being made between machines that are heavier than or lighter than air. All entrants must belong to countries that are members of the F.A.I., however, and on their journey round the world must call at Paris, London, Berlin, Rome or Bucharest, Karachi, Tokio, San Francisco and New York. The pilots may start from any of these cities and may cover the itinerary in any direction. They are not of course expected to cover in single hops the distance between the towns mentioned.

The flying time taken by each competitor to travel round the world will be measured, and an average speed of at least 62.14 m.p.h. must be maintained. The first winner of the cup will be the first competitor to exceed this speed. The cup will then become the property for one year of the National Aero Club whose member won the trophy, and a replica will be awarded both to the winner and to the Aero Club. The first competitor to complete the circuit at a speed of about 310 m.p.h. will win the cup definitely for his country.

Blind Flying

On page 434 of our issue for June 1932 we published an article dealing with the science of blind flying, in which we described the usual methods of training pilots in this very important aspect of piloting. An interesting departure from the normal methods has been made at the R.A.F. Central Flying School. The instructors at this school, admitted to be the finest in the world, found that in spite of hours of tuition many pupils continued to pay attention to the promptings of their senses of feel and balance. When flying blind it is essential that all these senses should be disregarded and that the pilot should fly entirely by means of his instruments.

A Vickers " Victoria " troop carrier has now been fitted with two complete sets of controls in the cabin. These face one another and thus the pupil may be made to sit facing the tail. The front cockpit is of course provided with all normal controls and the pilot here can take the machine out of the charge of the pupil if necessary. It is claimed that even the most refractory pupil rapidly learns to disregard everything but his instruments, in this machine.

World's Altitude Record

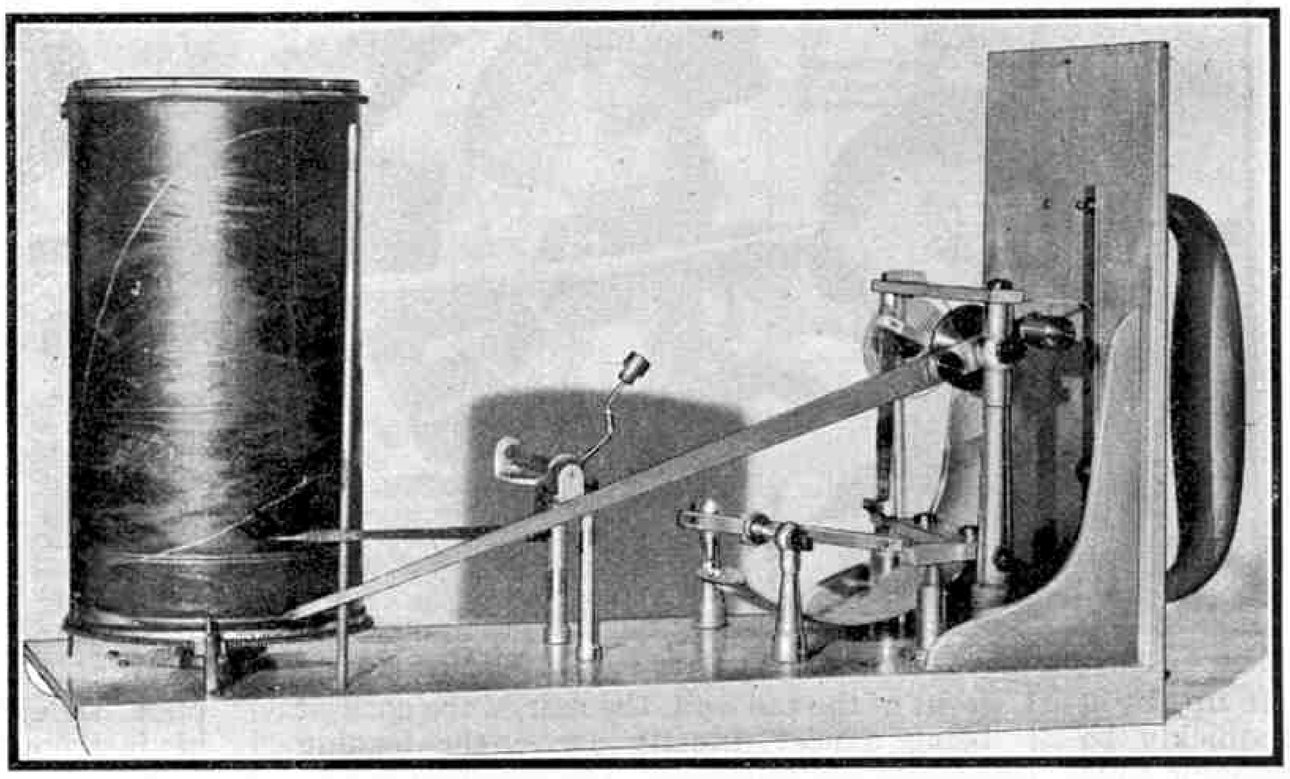
Triumph of New British Supercharged Engine

ON 16th September last Flt. Lt. C. F. Uwins, the Bristol Aeroplane Company's chief test pilot, succeeded in establishing a new world's altitude record for aeroplanes by attaining a height of 13,404 metres, equivalent to 43,976 ft., in a Vickers "Vespa" biplane equipped with a Bristol "Pegasus S" engine developing 550 h.p. This is the first time that the record has ever been held by England, although the last record but one, set up in May 1929 by Herr Willi Neuenhofen, was made in a Junkers W. 34 machine fitted with a Bristol "Jupiter" engine.

The Vickers "Vespa" biplane in which a new world's altitude record was made. We are indebted to the Bristol Aeroplane Co. Ltd. for the illustrations to this article.

The British attempt was undertaken by the Bristol Company with the primary object of establishing the efficiency of the recently-produced "Pegasus" engine fitted with the latest type of supercharger. The record set up is 876 ft. higher than the previous one, which was 43,100 ft. made on 4th June, 1930, by an American pilot, Lt. Apollo Soucek, U.S.N. Lt. Soucek flew a Wright "Apache" aeroplane fitted with a Pratt & Whitney engine.

Flt. Lt. Uwins' successful flight was his third attempt on the record in the Vickers "Vespa." On the first occasion he attained an altitude of 36,000 ft., but at that height experienced trouble with the oxygen breathing apparatus fitted in his machine, and was forced to descend. The next time a height of 41,000 ft. was reached. On the record-breaking flight the machine was 3,850 lb. in all-up weight, and carried on board 50 gals. of petrol and 6 gals. of oil. It remained in the air for about two hours, the actual descent from the maximum height attained occupying 20 minutes.



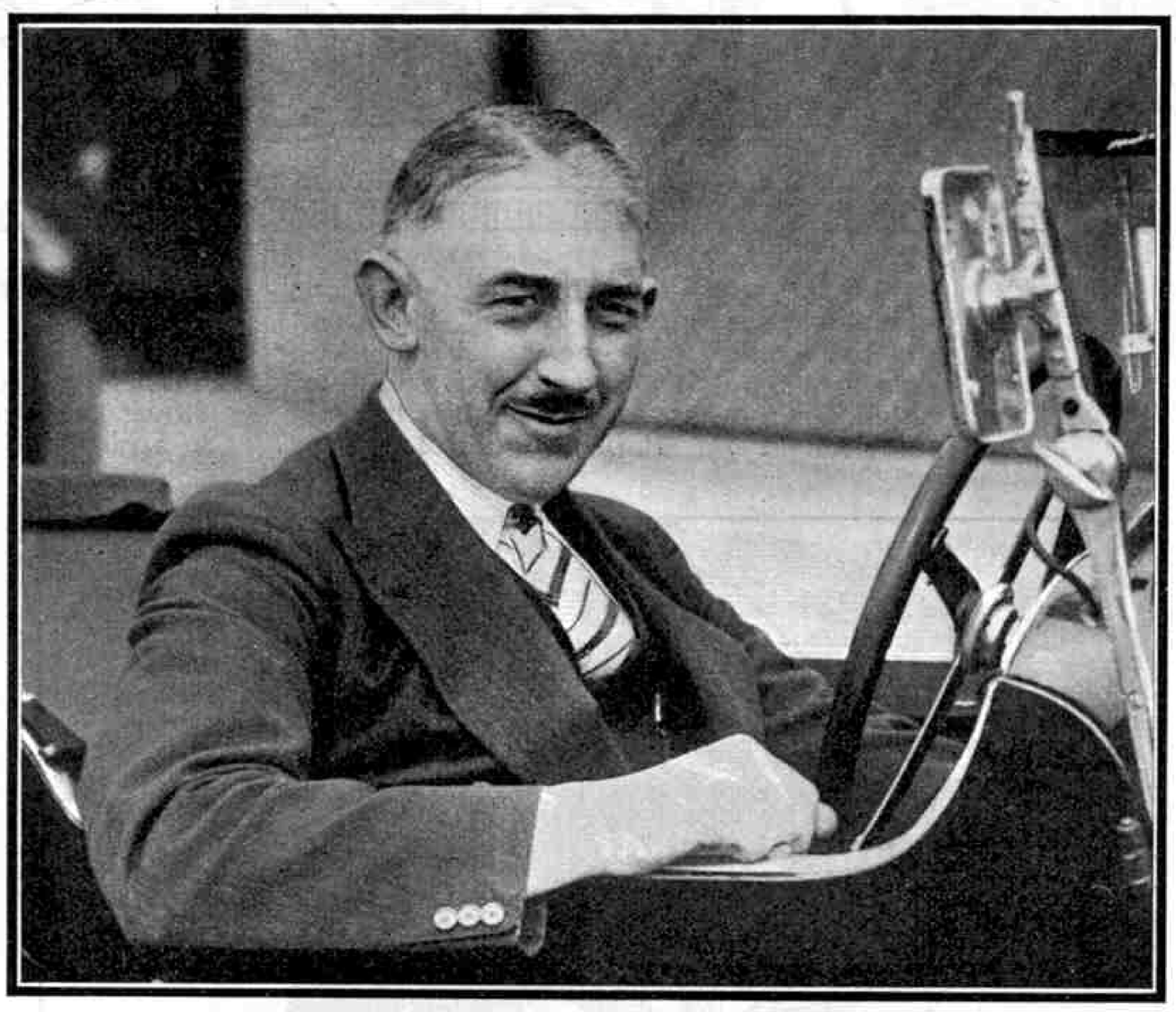
The actual record of the altitude flight on the barograph that was taken up with the machine.

The "Vespa" machine in which the attempt was made is a standard one and was constructed in 1927, since when it has seen a great deal of service in various parts of the world. It was marooned for some time at Nanking Aerodrome, in China, with water up to its wings! The type was designed as a two-seater army co-operation biplane, and was originally fitted with a Bristol "Jupiter" engine. It is not standard equipment in the R.A.F., but it is employed in the air forces of a number of foreign countries. The type was selected for the attempt owing to its large wing area, the wing span being 50 ft., and the fact that it is particularly suitable for high altitude work. A practical proof of this was given a few years ago when it was employed for the training of Bolivian pilots at the aerodrome at La Paz, which itself is at an altitude of 14,000 ft.

For the purpose of this flight the machine had to be slightly adapted to make it suitable for flying at a height of more than eight miles above the earth. A special Rotax dynamo, weighing only 27½ lb., was provided to generate electricity for heating purposes. This was driven by the engine, and generated current at 14 volts 25 amps. at a speed of 1,800 r.p.m., and maintained this output up to 3,000 r.p.m. An accumulator was carried for use in case of emergency. The current from the dynamo was taken to heating elements in the pilot's clothing and goggles, and the valves of the oxygen breathing apparatus also were heated to prevent them from sticking as a result of the intense cold. A particularly interesting feature was the provision of a cut-out switch on the joy-stick. This was arranged so that if the pilot should

become unconscious and let go the stick, the engine would be cut off, thus preventing the machine from going into a power dive.

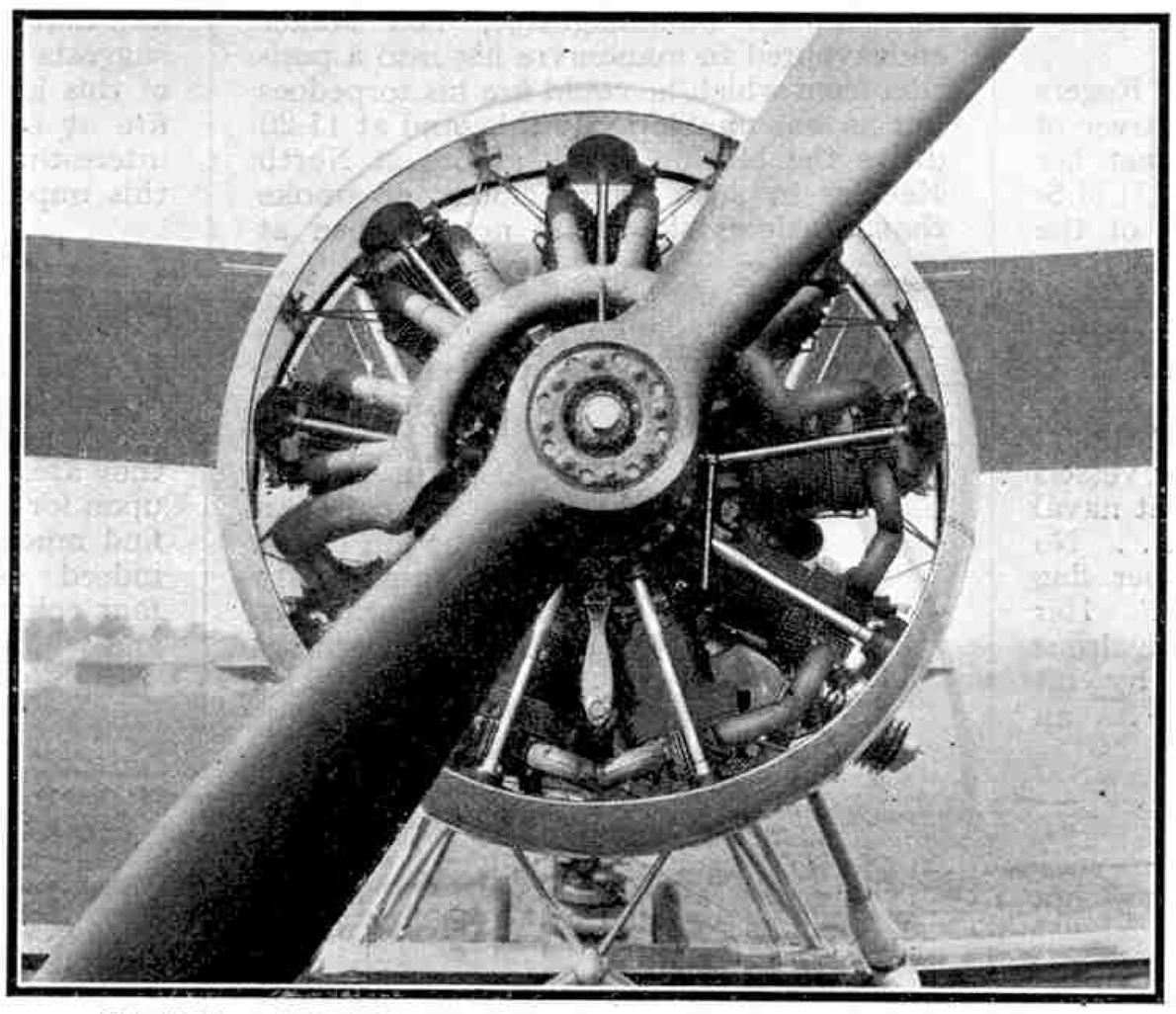
It was found necessary to provide large cooling surfaces for the oil in spite of the cold experienced at the great altitudes at which the aeroplane flew, the reduction in density of the air preventing the same amount of heat from being carried away. Standard plugs were employed, but only after a series of tests had been carried out by K.L.G. Sparking Plugs Ltd. that made it possible for them to assure the Bristol Company that the plugs would operate safely at any height likely to be reached. Another feature that was discovered during the first flight was that at altitudes of between 30,000 and 35,000 ft. the aileron control completely disappeared. This was due to the difference in the coefficiency of expansion of the wings and the control surfaces and was overcome by including special loading devices. These were marked, and after the flight it was found that the wings had contracted by a quarter of an inch.



Flt. Lt. C. F. Uwins, test pilot of the Bristol Aeroplane Co., who set up the new record.

Flt. Lt. Uwins was not able to rely on the correctness of his instruments during the flight, for it was found that when flying at a height of 44,000 ft., his airspeed indicator was registering a speed of 55 m.p.h. when actually he was flying through the air at more than 130 m.p.h. The temperature of the air was then –57°C., while in the cock-pit the temperature was –16°C.

The greatest difficulty that is experienced when flying at a great height arises from the fact that the rarefied atmosphere is not only barely sufficient to support the machine, but also causes the engine power to drop considerably. For instance, on attaining a height of 18,000 ft. an engine rated at 100 h.p. at ground level would be found to be delivering only 50 h.p.; and on climbing to 40,000 ft. this output would drop to 15 h.p. The "Pegasus" normally develops 550 h.p., but at the ceiling reached by Flt. Lt. Uwins it dropped to 170 h.p. In order to ascend to great heights there are the alternatives of using a very large engine of high power, which would be prohibitive on account of both bulk and weight; and employing a power plant of more moderate size and force-feeding or supercharging as the air density decreases in order to maintain the power as the aircraft ascends, and to make up the loss in weight of the mixture being fed into the cylinders.



The 550 h.p. Bristol "Pegasus" engine mounted in the Vickers "Vespa."

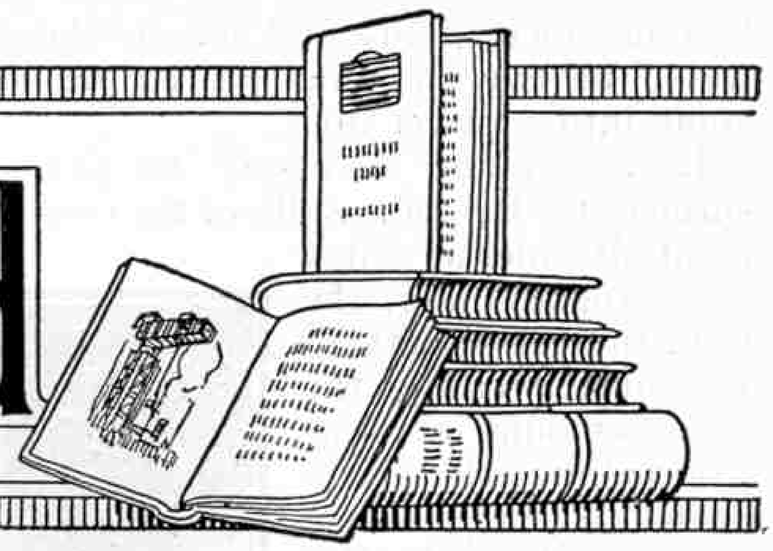
Practically all aircraft engines are of the internal combustion four-cycle type similar in principle and operation to motor car engines. The normal four-cycle engine sucks in its charge by what is termed natural aspiration. This means that when the inlet valve is open, the piston travels down its stroke and draws in the charge, which consists of a suitable air fuel mixture, the air being at normal atmospheric pressure on the ground, 14.7 lb. per sq. in. The same cycle of operations will take place at, for example, 18,000 ft., but the power output will only be half at this altitude unless the air has been compressed by supercharging it.

The design of a suitable supercharger or force feeding apparatus for maintaining power at a great altitude, or alternatively for obtaining the maximum power from a given size of engine, as in the case of the motor car, is one of the most intricate problems that have been undertaken by internal combustion engineers during recent years. Various methods have been employed for dealing with this necessary increase in the volume of air. In the case of the small, high-speed motor engines, a direct displacement blower has been almost universally adapted. This type is rarely used for aircraft engines, however, for various technical reasons, notably its weight and bulk.

In order to produce a supercharger suitable for use with their new range of "Mercury" and "Pegasus" engines, the Bristol Company have carried out extensive research on supercharging, in collaboration with the Royal Aircraft Establishment, and as a result have developed a centrifugal fan type blower. Much

(Continued on page 917)

Books to Read



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Old Swan, Liverpool, adding 1/– for postage to the price. Postages on different books vary, but any balance remaining will be refunded.

"The Indian Ocean"

By Stanley Rogers
(Harrap. 7/6)

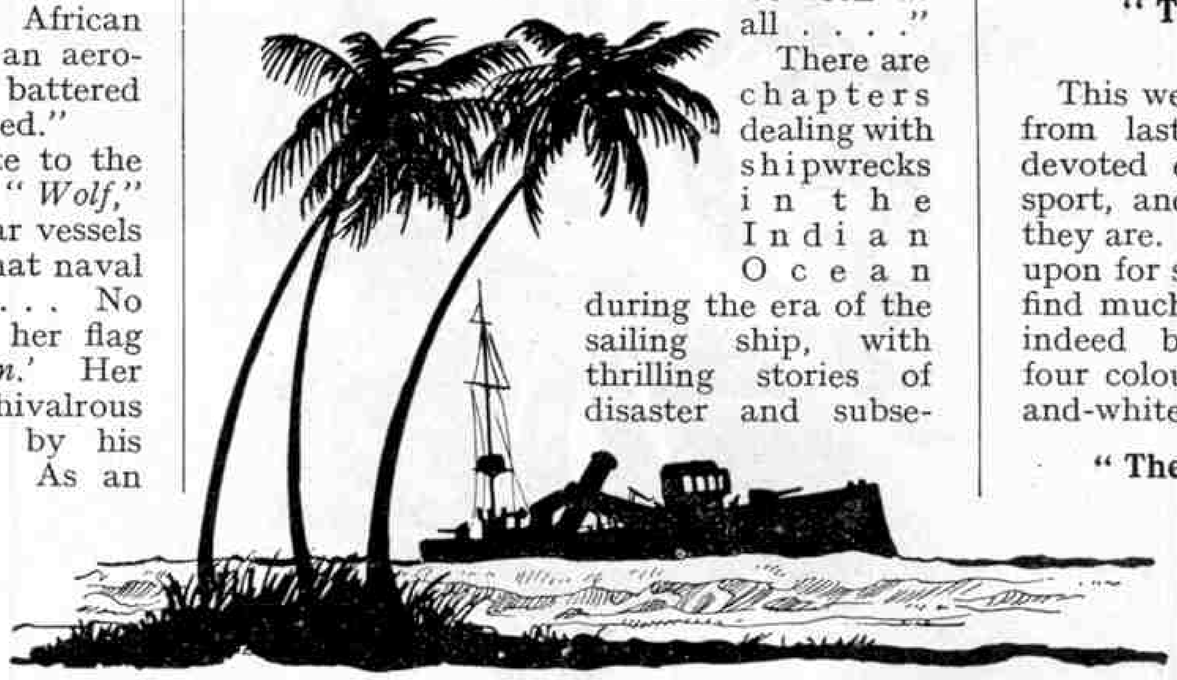
In writing his books (of which this is the third) dealing with the great oceans of the world, Mr. Rogers has the advantage that as he himself has voyaged all over the globe, he writes from his own knowledge. As he is also an artist he is fortunate in being able to add to the charm of his volumes by providing excellent illustrations. His latest publication contains chapters that cover almost all phases of his life afloat in the Indian Ocean, and includes such subjects as the Early Adventurers, the Sea Rovers, Monsoons and Typhoons, War Days, and Shipwrecks. Naturally, a chapter is devoted to the famous East India Company that did so much to build up England's prosperity in the East.

In his chapter on War Days, Mr. Rogers recounts the brief and inglorious career of the "*Konigsberg*," which finally met her doom when she was discovered by H.M.S. "*Chatham*" hidden up a branch of the Rufiji River, screened by the African jungle. Here, with the help of an aeroplane, she was "reduced to a battered wreck and her guns for ever silenced."

Mr. Rogers rightly pays tribute to the German cruisers "*Emden*" and "*Wolf*," which "were the only German war vessels in the Indian Ocean to put up what naval men would call 'a good show' . . . . No ship brought greater honour to her flag during the war than the '*Emden*.' Her captain, Von Müller, a clean and chivalrous fighter, was respected as much by his enemies as by his own people. As an enemy out to destroy merchant shipping he was bound to do his duty, and he carried out his unpleasant task as humanely as possible, invariably treating his adversaries with courtesy and consideration."

How the "*Emden*" worked as an independent commerce raider, capturing or destroying twenty merchant ships and sinking two enemy men-of-war, is well told. A drawing by Mr. Rogers (reproduced on this page) shows the final scene, when on 9th November, 1914, she met her doom at Cocos-Keeling Island at the hands of H.M.A.S. "*Sydney*," who having picked up the S.O.S. signal from the Cable Company's employees, raced to the rescue. At the end of the action "only one funnel remained; the stricken ship was burning fiercely and the 'tween decks were a shambles but still she fought on. Both fire control stations were gone and although the '*Emden*' was now almost unmanageable, Von Müller endeavoured to manœuvre her into a position from which he could fire his torpedoes but he was unable to do this, and at 11.20 drove the blazing wreck ashore at North Keeling in such dense clouds of smoke that at times she could not be seen at all . . . ."

One of the famous Indiamen whose record-breaking passages are dealt with in "The Indian Ocean," reviewed on this page.



The last of the "Emden." (See above.)

There are chapters dealing with shipwrecks in the Indian Ocean during the era of the sailing ship, with thrilling stories of disaster and subsequent landings on unknown islands; and in a chapter on "Sea Rovers" the author tells of the successes and reverses of some of the bold privateers of a century ago.

Mr. Rogers has produced a thoroughly readable book that will be a source of keen enjoyment to all who are interested in nautical matters.

"Camp Fire Yarns and Stunts"

By V. Barclay
(Brown, Son & Ferguson Ltd. 2/– net)

This little volume will be found useful by Rover Leaders, Scout Masters and Guiders in arranging enjoyable evenings round the camp fire as a round-off to the day's work. It provides interesting material for "stunts" and games, and also includes a great variety of what are called "potted yarns," or brief outlines from which interesting stories may be made. Some of the stunts take the form of mild practical jokes demanding "victims," but all are good humoured in character.

A particularly interesting section of the book deals with the use of signs, and many readers will be surprised to learn that more than 100 signals with a definite meaning are in common use, and at least 40 of them may be employed automatically in the course of a single day. Another chapter deals in an attractive manner with the history and folk lore that may be learned when hiking, and suggests how stories based on discoveries of this kind may be told round the camp fire at night. The book is full of other interesting ideas and suggestions for this important feature of scout life.

"The School Boy's Annual"

(R.T.S. 3/6 net)

This well-known annual shows a change from last year's volume in that it is devoted entirely to tales of school life, sport, and adventure, and excellent tales they are. All parts of the world are drawn upon for subjects, and the boy who fails to find much to arouse his keen interest will indeed be hard to please. There are four coloured plates and numerous black-and-white illustrations.

"The Empire Annual for Boys"

(R.T.S. 7/6 net)

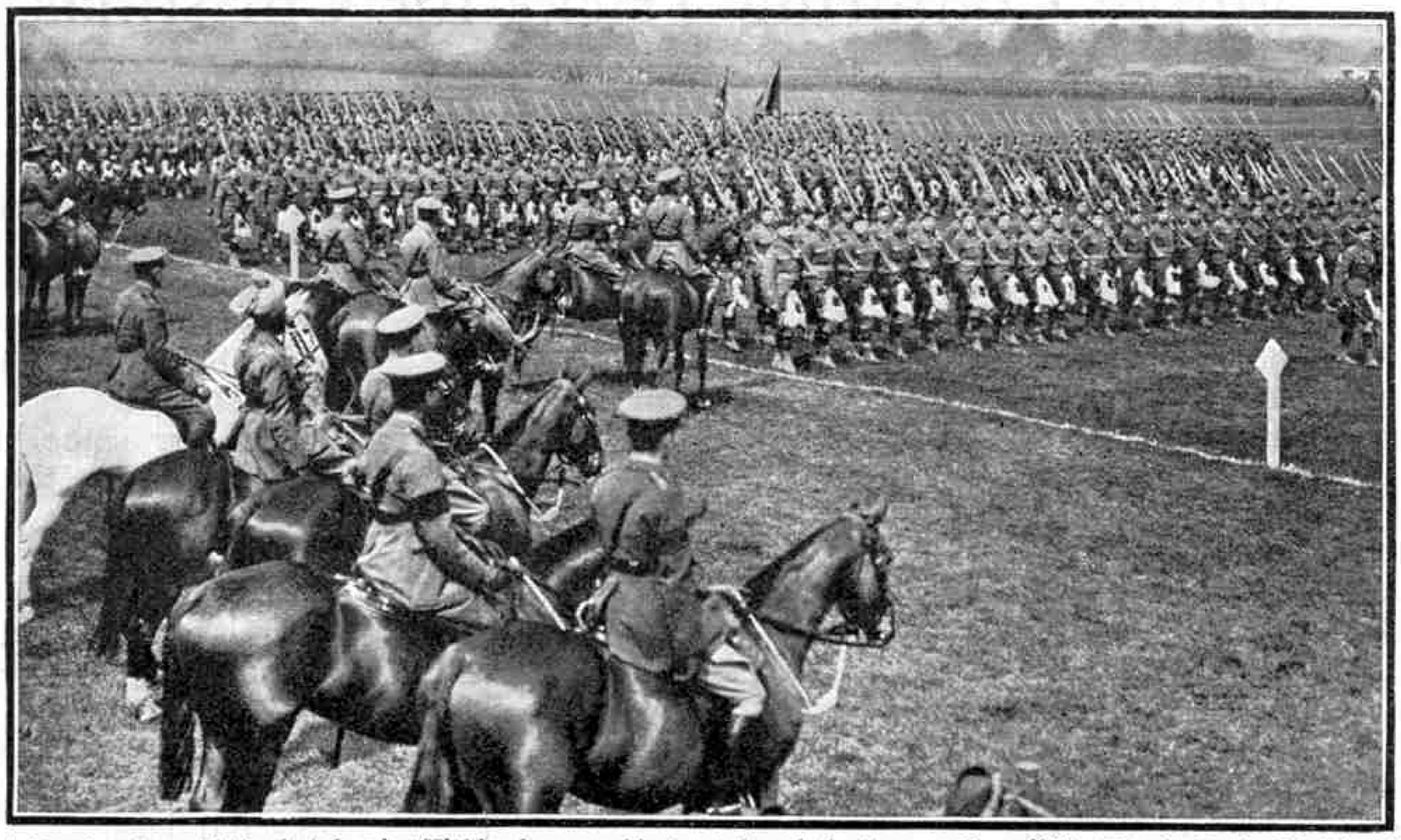
As in previous years this well-known annual contains a good collection of tales of adventure, sport, discovery and school life. All these are good, the adventure stories in particular being well written and full of exciting incidents. There are also general articles on hobbies and sports, giving practical advice from experts. Black-and-white illustrations are provided on a generous scale, and there are specially attractive full-page plates, four in colour and four in photogravure. The book forms an ideal present for any young man.

"The Wonder Book of Soldiers"
(Ward, Lock. 6/-)

However much we may loathe war, it remains to-day as true as ever that boys love soldiers, for a soldier appears the very embodiment of gallantry, romance, and honour. Now that the partial return of full dress has brought back to the Army some of the colour and ceremony of pre-war days, the soldier is a greater attraction than ever.

"The Wonder Book of Soldiers" not only describes Army life in all its branches under present-day conditions, but it also gives the story of the Great War in a nutshell. This is a story that boys of to-day should read, for in the majority of cases their own fathers and uncles (perhaps even their mothers and aunts, too!) were among the heroes (and heroines) of the mighty struggle. Every phase of the Army is covered by text and pictures, including interesting articles on the Territorial Army; uniforms and badges of rank; military honours and rewards; the colours; the life of a soldier; army manœuvres; signalling; and regimental pets; as well as many other subjects of equal interest.

The book is well illustrated with twelve colour plates and 300 fine pictures in half-tone.



A Royal review at Aldershot showing Highlanders marching past the saluting base. From "The Wonder Book of Soldiers" reviewed on this page.

"Cycle Repairing and Adjusting"
(Cassell & Co. Ltd. 1/6 net)

This volume is one of the well-known "Amateur Mechanic and Work" handbooks issued by Cassell & Co. Ltd. These are standard works on various branches of craftmanship, and the present volume is a typical member of the series. It is intended for the use of cyclists and cycle repairers, and provides thoroughly practical information on the complete overhaul of a machine, and on the manner in which it should be repaired. It also describes how to prepare cycles for re-enamelling and re-plating, and gives full instructions on re-enamelling at home. A particularly interesting chapter describes how to build a machine from standard fittings. The book is well illustrated, and the many drawings include a splendid series in which every part of a modern bicycle is shown.

"The Riddle of the Frontier"
By Robert Harding. (R.T.S. 2/6 net)

Mr. Harding's name has come to be a guarantee of an exciting story. In this book we are told how Private Robert Cranton of the 5th Tuffshire Regiment, "the smartest regiment in the Punjab," assists the Secret Service to prevent an Afghan revolt that is being mysteriously organised near the Indian frontier. Exciting adventures follow one another in quick succession, and from first to last there is not a dull moment. The interest of the volume is increased by a frontispiece in colour.

"The Boy's Own Annual"
(R.T.S. 12/6 net)

This is the 54th volume of this fine annual, and it is as rich in good things as any of its predecessors. There are excellent stories of adventure in Africa, China and elsewhere in the East, with thrills enough to satisfy anyone; and lovers of well-written school yarns are as usual well catered for. It is pleasant to note that the interesting "Behind the Scenes" series appears to have become an established feature. The topics dealt with in the present volume cover a wide range, including "Making Electricity," "At the Gasworks," "The Evening Paper," and "London's Water Supply." The articles on outdoor sports are thoroughly practical and useful, and those of the "how to make" type and on stamp collecting are well up to the standard. The illustrations are numerous and excellent.

The famous mascot of the Royal Welch Fusiliers. (See above.)

"Carburetters and Carburation"
By A. W. Judge, A.R.C.Sc.
(Chapman & Hall. 4/- net)

This is the second of a series of manuals on the construction, maintenance and repair of motor cars of all types. The first volume deals with automobile engines, including oil engines of the Diesel type, and was reviewed on page 805 of the "*M.M.*" for October, 1931; in the present volume the author is concerned with carburetters and their work. He first explains the nature of motor car fuels and the principles on which their combustion depend, and then describes the most important types of the devices employed to introduce an efficient explosive mixture into the cylinders of automobile engines. Special attention is paid to the actual fitting of carburetters and of various accessories, and private owners will find a wealth of useful information in the chapter on adjustment and tuning of carburetters and on tracing troubles.

As was the case with the first volume of this series, the illustrations are a notable feature. They are very numerous, and include a large number of clearly drawn and instructive diagrams, in addition to photographs.

"The Wonder Book of Science"
(Ward, Lock. 6/-)

Every day, science is revealing new wonders and opening up new lines of thought. Although it is impossible in a single volume to tell more than a little of the wonderful story of life and of the worlds around us, this book is a mine of information and interesting reading. In it some of our eminent scientists relate in simple language enough of the story to make us want to know more.

There are chapters on a journey to the moon; the wonders of the atoms; the story of the rocks; preserving our food supplies; the romance of steel; and how we feel, see, smell, taste and hear.

Three hundred illustrations and diagrams and twelve plates in colour help to make everything clear.

"The Girl's Own Annual"
(R.T.S. 12/6 net)

This year's volume will make a greater appeal than its predecessors to girls in their 'teens. Previously the annual contained the monthly numbers of the "*Woman's Magazine*"; these are now issued in a separate annual, so that the 576 pages of the present volume are entirely devoted to girls' interests. The serial stories follow familiar lines, but they are full enough of exciting adventures to draw the reader inevitably on to the next chapter. There are many interesting and practical articles on hobbies and sports of various kinds and the volume is produced and illustrated in its usual excellent style.

Puzzle Your Sharp-Eyed Friends

Simple Conjuring Tricks for Christmas

By Norman Hunter

THE job of making some simple piece of apparatus for a conjuring trick is almost as fascinating as performing the trick itself. I have therefore included in this article one or two tricks that require certain appliances that can easily be made at home by any reader who is at all handy with tools.

First of all I am going to describe a special table top for the use of the amateur magician. This table is constructed on exactly the same principle as some of the stage tables used by professional conjurers, and many startling effects are made possible by its use.

The table top is shown in Fig. 1, and it will be seen that it is a kind of box placed upside-down on the table. The sides are of wood and the top is of three-ply covered with black velvet. The sides should be shaped as shown in the illustration, and small ornamental feet fitted to the four corners will improve the look of the appliance, in addition to providing a clear view underneath it for the spectators, and thus disarming any suspicion they might have felt if it had been solid down to the top of the table proper.

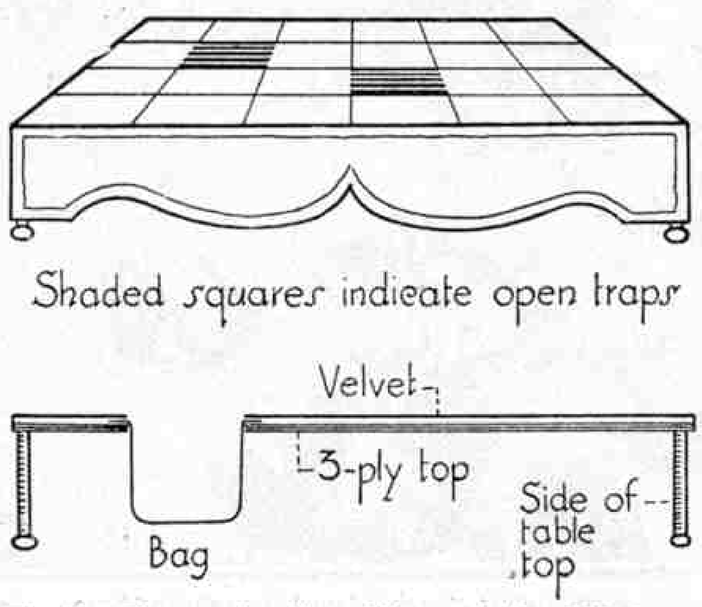


Fig. 1. The construction of the conjuring table top.

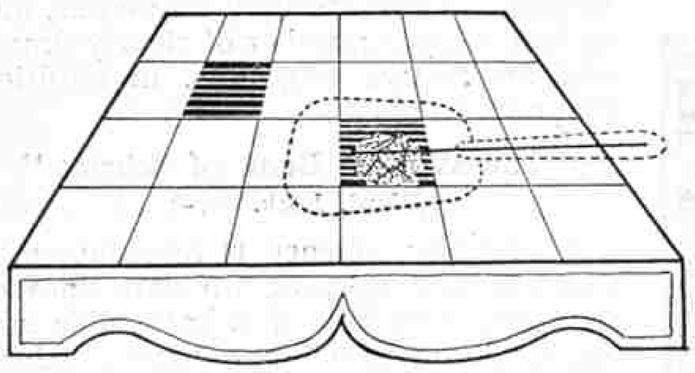


Fig. 2 shows the bundle of silks placed in one of the open traps of the table and covered by the fan.

Before the table top is covered with velvet it is marked out in squares, and the wood in two or more of these squares is cut out with a fret-saw. Small bags of black velvet are glued into these holes, and after the top has been covered with black velvet, the material is cut away to correspond with the holes. Thus we have a black velvet-covered table top with two or more square open traps. At this stage these traps are visible, and to mask their presence the top of the table proper is outlined in squares with narrow ribbon of bright yellow or bright green colour. This breaks up the surface, and by artificial light it is impossible for anyone not in the know to detect the presence of the open traps.

The table top may be finished off by enamelling the sides and painting or stencilling a small design in the centre of each.

The top should stand about 5 in. or 6 in. above the table on which it rests, and this will allow the bags in the open traps to be about 4 in. deep. The size of the top will depend upon individual needs. If it is to be used only at home it may be the same size as the table that is generally used for the performance; but if it is to be taken about to the houses of friends it should be of a size to fit comfortably into a suitcase, about 14 in. wide by 20 in. long, or perhaps a little smaller.

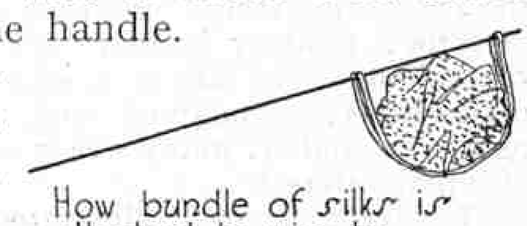
Now for some tricks in which the special traps in the table can be used.

FANCY GOODS

The conjurer shows a Japanese fan, not the folding kind, but the flat kind; and also an empty bowl. He covers the bowl with the fan for a moment, and immediately the bowl becomes filled to overflowing with coloured silks and flags.

How it is done. The bowl is an ordinary one made of metal or papier mache. The fan also is unprepared, but used with it is a length of stout wire painted black. This wire is about 1 in. shorter than the fan, including the handle.

Make up your silk handkerchiefs, flags and ribbons into a bundle small enough to go easily into the bowl, and also to be hidden comfortably behind the fan. Do not fold all the silks; crush some of them up anyhow, so that they will expand freely when released. Now attach your bundle to one end of the wire with an elastic band in the following manner. Slip one end of the elastic band over the end of the wire. Hold the bundle of silks against the wire, take the two strands of the elastic band, wind them together round the bundle, and slip the other end of the band over the wire. The top diagram of Fig. 3 explains this clearly.



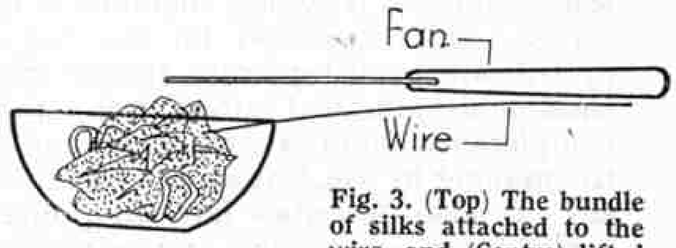


Fig. 3. (Top) The bundle of silks attached to the wire, and (Centre) lifted with the fan. (Bottom) Releasing silks by withdrawing fan and wire.

Prepare for the trick by laying the wire on the table top in such a position that the bundle goes into one of the open traps. As the top of the table is above the eye-level of the audience it cannot be seen. In any case the bowl may be stood upside-down over it.

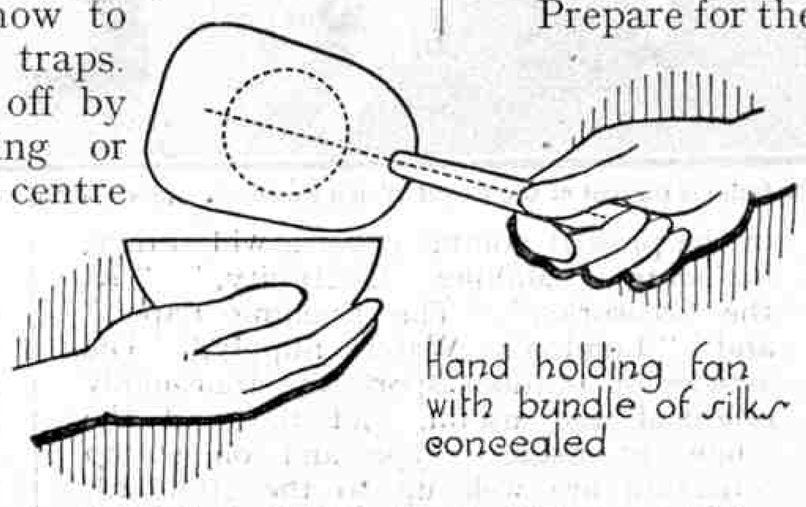


Fig. 4. Placing in bowl the bundle of silks concealed by the fan.

Commence by showing the fan on both sides, and then lay it down so that the handle is just over the wire loop and parallel with it. (Fig. 2.) Now take up the bowl and show it empty. Pick up the fan, and with it the wire,

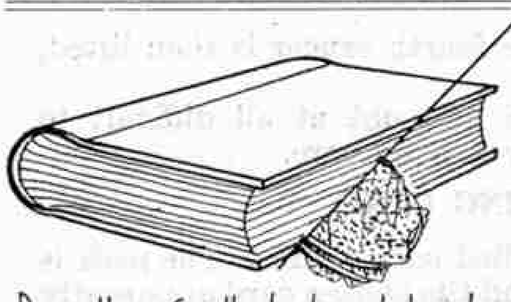


Fig. 5. If no table is available the bundle of silks can be hidden behind a book.

turning the fan flat-way on to the audience, so that the bundle of silks will be hidden behind it. (Fig. 4.) Place the fan over the bowl and draw it off again towards you. (See the centre and bottom diagrams of Fig. 3.) The bundle will be pushed off the rod and the silks released from the elastic will well up in great profusion, seeming to be more than enough to fill the bowl several times. Reference to the diagrams will make the performance of this trick perfectly clear.

If you do not wish to use the special top I have described, you may place the wire rod on a book, the bundle being concealed behind it, as shown in Fig. 5.

Now for a trick with no special apparatus at all.

THE MESMERISED GLASS

The conjurer hands a wine glass for examination, and on receiving it back he stands it upside-down on the table. Then borrowing a handkerchief, or using one of his own, after examination he twists it ropewise and lays it over the glass. Making a pass with his hands he lifts the two ends of the handkerchief, and to the astonishment of the spectators the glass adheres to the handkerchief and is thus carried across the room. The glass and the handkerchief are again passed round for inspection.

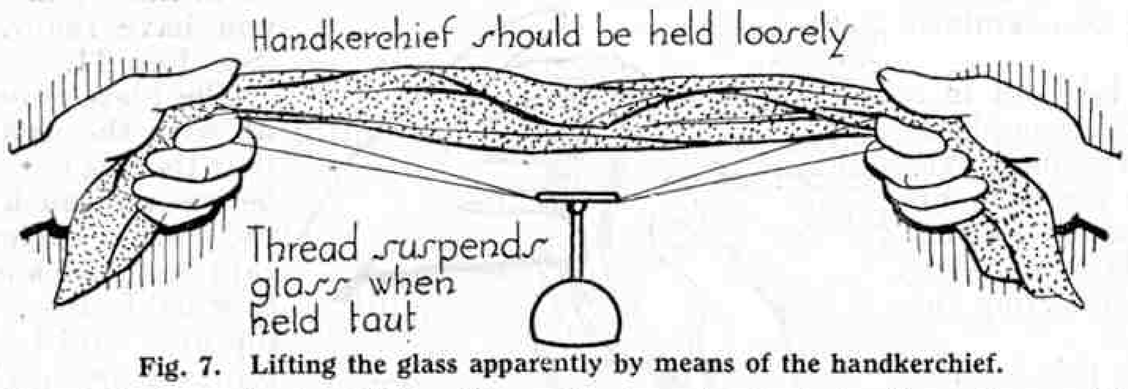


Fig. 7. Lifting the glass apparently by means of the handkerchief.

How it is done. All that is required is a loop of fine black thread rather less in length than an average handkerchief measured diagonally from corner to corner. The loop of thread is laid on the table, opened out so as to be several inches apart at the centre.

When the glass has been examined it is placed upside-down in the centre of the loop, as shown in Fig. 8. The handkerchief is twisted up and laid over the glass, and then when the ends of the handkerchief are picked up, the first finger of each hand hooks into each end of the loop of thread, drawing it taut under the foot of the glass. In Fig. 9 the thread and suspended glass are shown well below the handkerchief so as to make quite clear how the trick is done. As long as the hooked fingers keep the thread taut, the handkerchief may be worked towards the centre with the thumbs and allowed to lie loosely along the glass. With ordinary care the glass may be carried safely about the room. Finally it is replaced on the table, the thread is allowed to drop, and glass and handkerchief may be inspected once more by those who are eager to find out the secret, which of course is no longer there for them to discover.

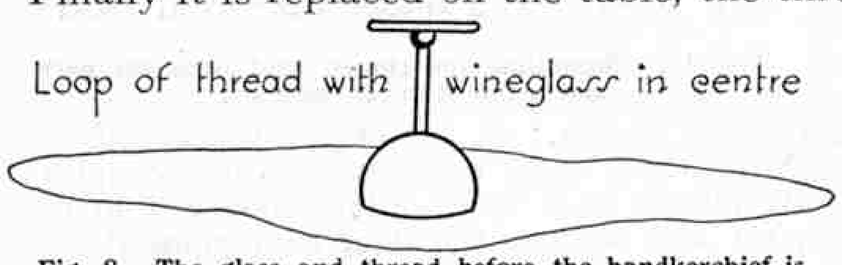


Fig. 8. The glass and thread before the handkerchief is laid on them.

Here is a showy little trick involving the use of a piece of easily-made apparatus that will come in handy for other tricks also.

ALL CHANGE

The conjurer shows a cloth bag and turns it inside-out to prove that it is empty. From the bag he now produces a blue handkerchief. He replaces the handkerchief in the bag and adds a handful of those little coloured balls used for throwing about at carnivals. When he picks the handkerchief out again it is found to be decorated with spots, presumably made from the coloured balls. Once more the handkerchief goes into the bag, and this time it changes into a solid cube with coloured spots, something like a fair-sized die. This again, on being thrown into the bag, becomes a handful of small dice that are poured out on to a plate. The bag is again shown to be empty.

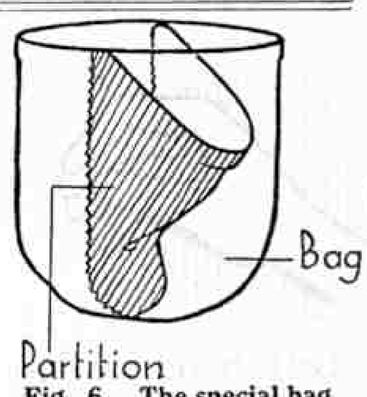


Fig. 6. The special bag used for the "All Change" trick.

How it is done. A special bag is needed, made of cloth and mounted on a ring at the mouth. A cloth partition, stretching across from side to side, divides the bag into two compartments. This partition may be swung to either side at will, and of course anything that is in the closed side cannot be seen when the bag is turned inside-out.

Reference to Figs. 9 and 6 will show how the bag can be made. The ring at the mouth of the bag is composed of two Meccano 12½" Strips bolted together and bent into a circle. Another 12½" Strip bent into a semi-circle is pivoted to the ring with nuts and bolts at each side, so that it may be swung from one side to the other. The bag proper is sewn to the ring. Another piece of the same cloth is sewn over the moving arm and down the sides and across the bottom of the bag. The moving arm should not be stitched to the partition, but should run through a kind of tunnel in the cloth made by turning the edge of the cloth over the metal strip and sewing it along.

Now let us call the two compartments of the bag A and B. Into A we place first half-a-dozen small dice, such as are used in various games; the spots can be coloured with paint. Then on top of these goes a solid wooden cube about 2 in. across, with similar spots of various colours. On this again is laid a spotted handkerchief. This can be bought at any fancy shop, and a plain handkerchief, matching as nearly as possible the background of the spotted one, should also be obtained at the same time. Failing this, two handkerchiefs exactly alike can be used, and one painted with spots. The plain handkerchief goes on top of the other articles, and the partition is then moved over to close side A of the bag.

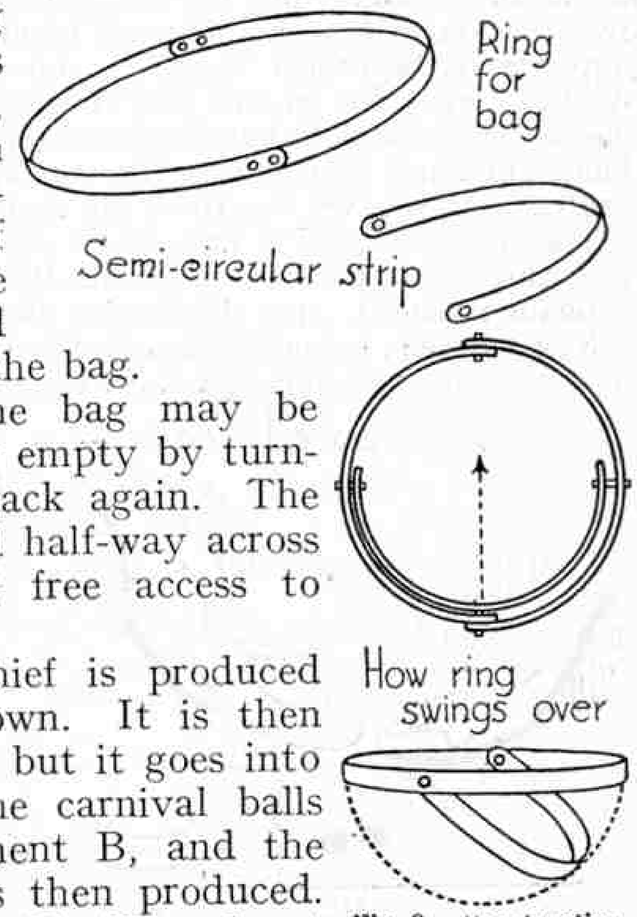


Fig. 9. Construction of the ring for the mouth of the special conjuring bag shown in Fig. 6.

In this condition the bag may be shown to be apparently empty by turning it inside-out and back again. The partition is then moved half-way across the bag, thus leaving free access to either compartment.

The plain handkerchief is produced from the bag and shown. It is then put back into the bag, but it goes into compartment B. The carnival balls also go into compartment B, and the spotted handkerchief is then produced. This in turn goes into side B, and out comes the cube from side A. Finally the cube is dropped into side B, the

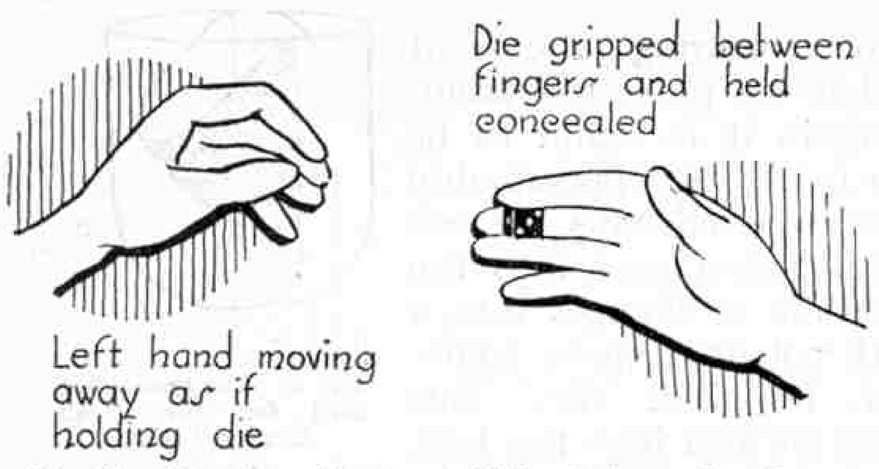


Fig. 10. The die retained and hidden between the fingers.

partition is moved across to close this side, the little dice are poured out of side A, and the bag again may be turned inside-out.

Now let us see what we can do with some of the little dice we have just produced.

VISITING DAY

Four saucers are shown and placed in a line, and one die is placed beneath each saucer. The conjurer then explains that it is visiting day, and that three of the dice will visit the fourth. He accordingly makes three of the dice vanish one by one, lifting the fourth saucer each time and showing that as each die vanishes it reappears under that saucer until all four dice are there together. Everything may be examined before and after the trick.

How it is done. The saucers are laid out in a line with one die in each. The conjurer then places each die on the table and inverts its own saucer over it. He does this by picking up the die with his right hand ; passing it into his left hand ; picking up the saucer with his right hand ; laying the die on the table with his left hand and inverting the saucer over it.

With the first two dice and saucers this is what the conjurer really does ; but the third time he does not take the die with his left hand, he only appears to do so. Actually he retains it in his right hand clipped between the first and third fingers ; and as the back of his hand is towards the audience the die is hidden. (Fig. 10.) He places his left hand on the table as if it contains the die, and at once inverts the saucer over the fingers that are supposed to hold the die, drawing the fingers away as the saucer goes down.

For the last saucer the die is openly laid on the table. The saucer is picked up with the left hand and placed upside-down in the right hand over the hidden die. The right hand then puts the saucer down over the visible die and leaves the hidden one also under the saucer.

At this point we have all four saucers inverted, and as far as the audience are aware there is one die under each saucer. Actually, however, there is no die at all under the third saucer, and there are two dice under the fourth saucer.

The first saucer is now picked up and the die under it is made to disappear by picking it up with the right hand and apparently transferring it to the left, but actually keeping it clipped between the first and third fingers as already described. The left hand moves away as if holding the die, and makes a crumbling movement over the fourth saucer. The left hand is then opened and shown empty and the saucer is raised, showing the two dice under it. While all eyes are on this new development the left hand places the saucer in the right hand and so over the concealed die. (Fig. 13.) The right hand then covers the two visible dice with the saucer, and of course leaves the third die there too.

The second saucer is now lifted, and the same movements are gone through to pass the die under the fourth saucer. The saucer is again replaced, and the hidden die left under it as before.

Now we come to the third saucer. As there is no die at all under this, it is easy to make a pass, lift the saucer, and show that the die

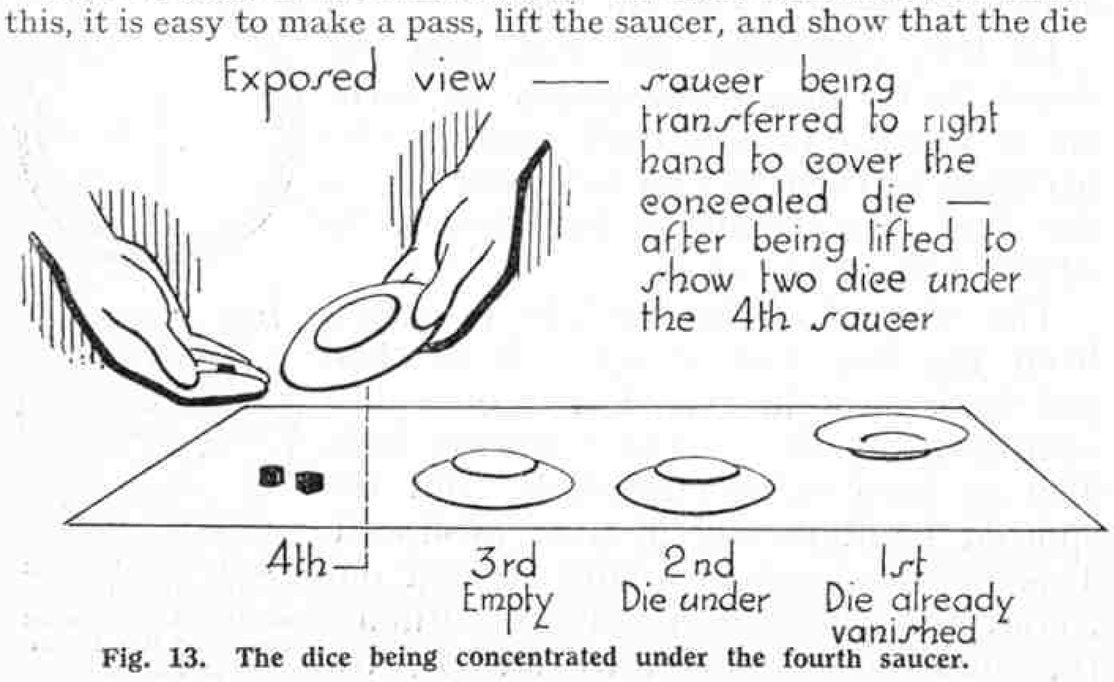


Fig. 13. The dice being concentrated under the fourth saucer.

presumed to be there has gone. The fourth saucer is then lifted, and there are all four dice together.

This trick is wonderfully effective and not at all difficult to perform. It needs no skill, but only a little care.

THE PENETRATING CARD

A card chosen from the pack is shuffled back again. The pack is dropped from a height on to a plate, and the chosen card apparently penetrates through the plate, for it is found on the table underneath.

How it is done. When the card has been chosen, ask the chooser to remember it and to show it to those situated near by. Cut the pack, and hold out the half in your left hand, asking the person who holds the card to place it face downward on top of the others. You now apparently place the half of the pack in your right hand on top of the other and shuffle. What you really do is to just tap the halves together, and instead of lifting up a few cards to shuffle to the bottom of the pack you lift off the entire half that is still in your right hand and which you have never let go. Without pausing you then shuffle all these cards on to the bottom of the other half, which leaves the chosen card on top of the pack. You can shuffle again by pressing with the fingers of your left hand on the top card, so that each time you draw some cards off, the top card slips back on to the top of the pack, and you shuffle the cards you have removed to the bottom of the pack. (See Fig. 11.)

Fig. 11. How the chosen card is kept at the top of the pack.

The plate is on a table on your right. Take it up with the right hand and turn it over to show that there is nothing concealed beneath it. Hold it between the pack and the audience, so as to conceal the pack. Under cover of the plate push the top card of the pack a little way off as if you were going to start dealing. Turn the plate over to show the top of it, still keeping it over the pack. Slide the top card forward under the plate, and grip it there with the fingers of the right hand. (Fig. 12.)

Place the plate on the table, get someone to shuffle the pack once more, and then drop the pack from a height on to the plate. Lift the plate and reveal the chosen card underneath.

A WIZARD IN SPITE OF HIMSELF

A spectator picks out the chosen card from the pack placed in his pocket, although he does not know what the card is.

How it is done. Have a card chosen and leave it on top of the pack after shuffling as described in the previous trick. Ask someone who has not seen the card to help you. Place the pack in his inside coat pocket, so that the top of the pack is towards the outside and the faces of the cards are towards his body.

Ask the chooser the name of the card. Tell your assistant he must touch your hand, and instantly plunge his hand into his pocket and remove the correct card. Impress on him the need for getting the card before the magic influence wears off his fingers. In 99 cases out of 100 your assistant will snatch at the first card that comes to his hand, which will be the one on top of the pack, and the one chosen. If, however, by accident or design, he produces the wrong card, tell him he was not quick enough and promptly plunge your hand—after showing it to be empty—into his pocket and produce the right card yourself.

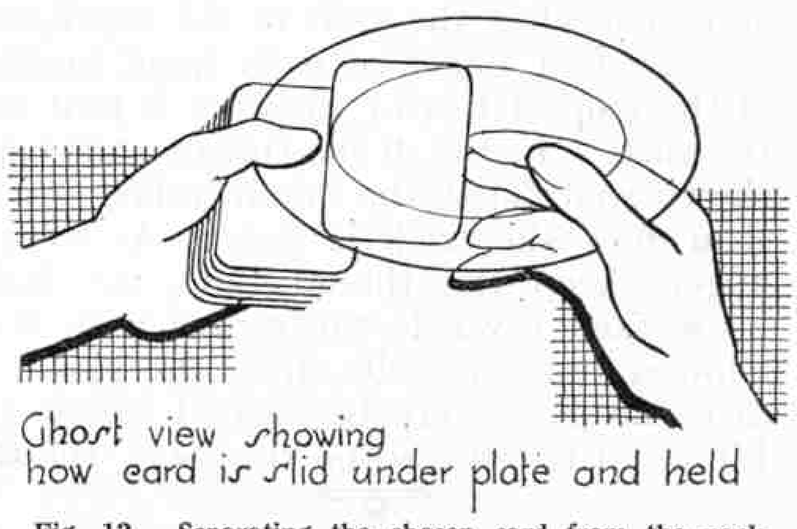


Fig. 12. Separating the chosen card from the pack and hiding it under the plate.

In conclusion I should like to emphasise the fact that there are two important points to be borne in mind by those who set out to learn conjuring. The first point is to practise every trick repeatedly in private before performing it before an audience ; the second is that, if at all possible, the same trick should not be repeated before the same audience because, knowing what is coming, they will have a much better chance of discovering the secret than if the effect were a surprise. In order to distract the attention of the audience at critical moments in the performance of a trick, a few jokes and witty sayings should be selected and memorised. Even when the greatest care is taken, it is always possible for some little thing to go wrong during the trick, and if the conjurer can keep on talking he has a good chance of remedying the mistake without the audience noting that anything has occurred.

Beginning a Record Collection

Many readers who are expecting to become the proud possessors of a gramophone for Christmas have written to ask for advice on starting to make a collection of records. It is not easy to give advice on this matter even when one knows the tastes of the people concerned; and in the absence of such knowledge it is extremely difficult to give any help of practical value.

The most important thing to avoid is monotony. In the early stages of gramophone enthusiasm there is always a temptation, after hearing a record that takes one's fancy, to buy several other records of a similar type. These are played over and over again until one becomes heartily sick of them, and interest in the gramophone suffers accordingly. The wisest plan for a beginner is to obtain catalogues from a local dealer and select a number of records of different and distinctive types, both instrumental and vocal. By following this plan the danger of monotony, which always exists while the collection of records remains small, is reduced to the minimum. Specialising in one particular type of record should not be indulged in until the collection has reached sufficient proportions to provide a background of variety.

The general tendency that is taken by any collection of records will naturally follow the tastes of its owner, but it should not be allowed to go to extremes in seriousness or the opposite. Even the keenest music lovers have times when they can enjoy "Mr. Flotsam and Mr. Jetsam," or "Alexander and Mose"; and on the other hand the most hardened humorous song enthusiasts can always enjoy a good musical record as a change. A varied collection of records provides the greatest amount of pleasure for its owner and also for his friends.

Recording Massed Brass Bands

When the bandsmen competing at the recent National Band Festival were playing their test pieces in the Crystal Palace, London, they believed that they were performing only for the benefit of the thousands of people present in that vast building. As a matter of fact their efforts were being recorded for the gramophone by "His Master's Voice."

The acoustics of the Crystal Palace can only be described as extraordinary, and in view of this fact, and the enormous volume of sound produced by the massed bands, it was feared that it might be impossible to obtain satisfactory records. The attempt was completely successful, and it represents a recording triumph for the firm.

Sir Henry J. Wood

Our portrait this month is of Sir Henry J. Wood, the famous English conductor. He was born in London in 1869, and received his first musical instruction from his mother. While still a boy he held various posts as organist, and gave organ recitals at different exhibitions from 1883 to 1889. Subsequently he conducted the Carl Rosa and other opera companies in London and in the provinces. In 1895 he was engaged by Robert Newman to conduct the Queen's Hall Promenade Concerts, with which he has been associated ever since.

Sir Henry J. Wood, the great English conductor. Photograph by courtesy of the Columbia Graphophone Co. Ltd.

The broadcasting of these remarkably popular concerts has become one of the outstanding musical features of B.B.C. programmes.

Sir Henry has done more than any other man to popularise high-class orchestral music in England. In particular English people owe to him their first knowledge of the orchestral works of the Russian composers Tchaikovsky and Scriabin; the Germans Strauss, Schönberg and others, and the Frenchmen Debussy and Ravel. He has also played a large part in introducing the works of British composers, many of which, but for him, might never have obtained a hearing. In addition to the continual introduction of new composers and new works Sir Henry has played a large part in raising the level of orchestral playing in England. He was knighted in 1911.

The Columbia Graphophone Company have produced a number of fine orchestral records under Sir Henry Wood's direction. These records bring out the conductor's strong interpretative individuality very clearly, and at the same time they demonstrate his masterly control of the orchestra. The most recent is that of the third Brandenburg Concerto for strings, by Bach, on Col. LX173 (12 in., 6/–). This concerto is the third of six of these compositions commissioned by the Margrave of Brandenburg and completed by Bach in 1721. A concerto normally is a solo for one or more instruments with orchestral accompaniment; in this work Bach divides his strings into three sections, containing violins, violas and 'cellos. These three sections play "against" one another, and the result is extraordinarily fascinating.

Records Worth Buying

The long-awaited recordings of the B.B.C. Symphony Orchestra, conducted by Dr. Adrian Boult, confirm the high reputation the orchestra created at their concerts. The performance of Beethoven's Eighth Symphony (H.M.V. DB1764-6) gives us the strings bowing together as one man; the brass rich, full and clean, and every wood-wind tone colour clearly defined. This symphony, which was one of the composer's own favourites, is a joyous work overflowing with the purest melody.

Another important recording is Elgar's Violin Concerto, played by the London Symphony Orchestra under the composer's direction, and with the youthful Yehudi Menuhin as soloist. The collaboration of this marvellous boy of 15 years and England's greatest composer, who is five times his age, is remarkably successful (H.M.V. DB1751-6).

The Crystal Palace brass band records referred to elsewhere on this page, "*The Hallelujah Chorus*" and "*Abide With Me*" (H.M.V. C2470-1), are worthily accompanied by two more recordings by the Aldershot Command Searchlight Tattoo massed bands, "*Marche Militaire*" and "*On the Quarter Deck*" (H.M.V. B4256). "*The Passing of the Regiments,*" a pot-pourri of familiar marching songs (H.M.V. B4275), well played by the band of the Coldstream Guards, will be popular with those who like such medleys.

Among instrumental records must be mentioned a fine rendering of Schumann's "*Traumerei,*" by the famous Russian violinist Mischa Elman (H.M.V. DA1144).

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

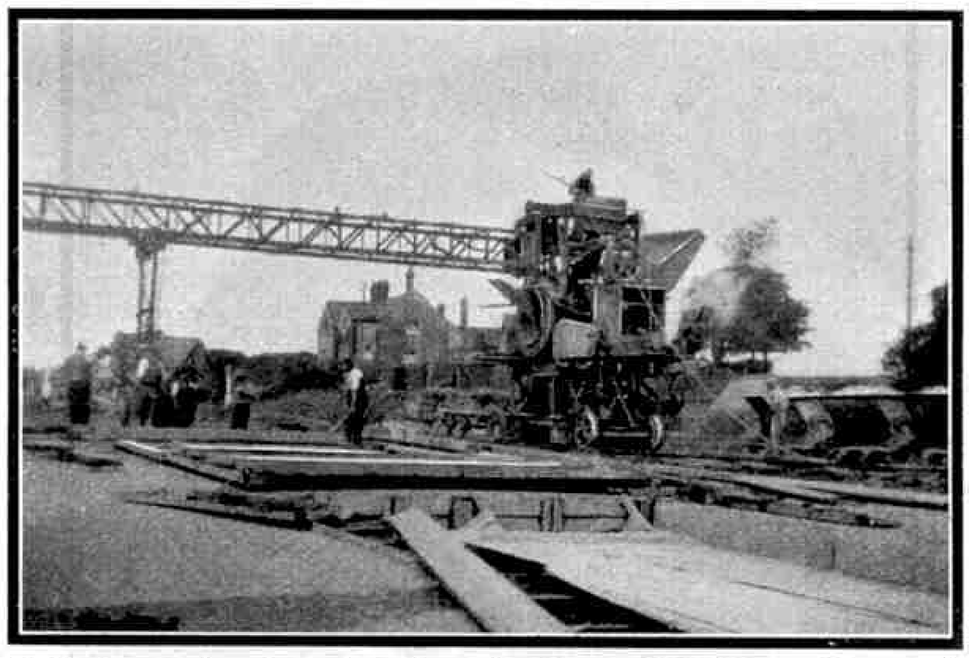
A New Lancashire Highway

The new Liverpool–East Lancashire Road runs in almost a straight line from Liverpool to Manchester and when it is opened next year will provide a splendid highway 33 miles in length. It has taken four years to build and its cost is expected to work out at about £108,000 per mile.

It has been very interesting to watch the creation of this great roadway. The work began four years ago with the erection of a chain of huts along the line to be followed. In these were accommodated the workmen engaged in the task, and in a very short time a temporary fencing was put up and work then began in earnest. Giant steam navvies excavated more than two million tons of earth from places above the designed level of the road, and this was taken away on light railways in order to form embankments at various points. More than 70 miles of track were laid down during this part of the work, and 39 locomotives and 500 wagons were employed in transporting the soil dug out. Finally the banks were left to settle in order to avoid subsidences after the completion of the roadway.

The next step was to form the bed of the highway, which consists of ash and clinkers; and altogether 1,500,000 tons of these materials were brought to the spot in lorries. This portion of the work resembled a colossal race, lorry owners striving to bring in as many loads per day as possible.

The bed of ashes and clinkers was thoroughly rolled and then concrete was poured on it to a depth of 10 in. No less than 300,000 tons of concrete were needed for this purpose, and this was prepared in enormous mixers similar to the one shown in the accompanying photograph. Finally a carpet of granite chips bound together by pitch was laid down in order to provide a smooth hard-wearing surface, and everything was ready for the opening.



A giant concrete mixer at work on the Liverpool-East Lancashire road. The photographs on this page are by W. T. Wilkinson, Haydock.

Carr Mill Bridge, near St. Helens, on the last section of the new Lancashire road to be completed. The ground under the railway track was excavated to form the roadway.

Many formidable obstacles had to be overcome while making the road. For instance, at Pennington the land was so soft that piles had to be driven in as supports, and these did not touch solid ground until they had reached a depth of 40 ft. Five bridges had to be built in one stretch half a mile in length near Haydock, and as there was a risk of the ground giving way above the coal mines in this district, these bridges had to be so constructed that they could be jacked up if necessary. At one period great local excitement was caused by blasting operations at Liverpool Road, Haydock, where hard rock had to be dealt with, while trouble of an entirely different kind was encountered at Carr Mill, St. Helens, for there the ground to be built over was a soft mixture of sand and clay.

The most extensive of the many excavations carried out along the road was near St. Helens, where a deep cutting was made through Windle Hill. This cutting is 120 ft. in width at the bottom, and the tops of its steep banks are 300 ft. apart. About 300,000 tons of hard sandstone and shale were dug out in forming it.

The road is as straight and as level as it could be made without undue expense and motoring along it may appear dull, for the monotony is broken only by occasional cross-roads. Where large main roads meet the new one, "circuses" of 120 ft. radius have been built, giving ample room for traffic. W. T. Wilkinson (Haydock).

In a Moroccan City

During a Mediterranean cruise I landed at Ceuta, on the African shore of the Straits of Gibraltar, and took the opportunity of visiting Tetuan, the capital of Spanish Morocco. I went there by train, the distance from Ceuta being 21 miles. The city includes a European quarter, in which are the Government offices. This was interesting, but except for the palms and the throngs of chattering natives it could have been taken for part of a European city.

The native quarter is entirely different. Most of its cobbled streets are narrow and winding and are provided with gutters that run down the middle. The most picturesque buildings are the mosques and sanctuaries, of which there are 33. Ordinary houses are built in a continuous line so that it is difficult to tell where one ends and another begins, and some of them actually span the streets and convert them into short dark tunnels. These buildings give scarcely any indication of life within, for the windows are heavily shuttered and they have heavy and imposing front doors, nearly all of which carry large iron knockers. Street lighting is not very efficient, and the lonely electric lamps, without shades or other protection, that are strung across the streets, chiefly at corners, seemed to me strangely out of place in their oriental surroundings.

A typical " shop " in the native quarter of Tetuan, the capital of Spanish Morocco. This photograph, and the one below, are by K. Jones, West Bromwich.

I was greatly interested in the shops, for these have no fronts and the wares on sale are made on the spot. For instance, a baker's shop contains his oven and is really a bakehouse; a blacksmith's may be recognised by the presence of his forge; and in others native cobblers may be seen cutting up skins, making slippers and decorating them.

During my stay in Tetuan I went into the School of Arts and Crafts, where I saw beautiful examples of carvings executed in wood by small native boys. In one room I was greatly interested to find other boys inlaying the stocks of long old-fashioned Moorish guns with a metal that had the appearance of silver, and in another native women were making carpets.

I was sorry when it was time to return, for Tetuan seemed to me the most interesting place I visited during my cruise. The sun was shining brilliantly when I left the city and as the train ran along the shore of the Mediterranean on the way to Ceuta I longed for a dip into its blue waters. KEITH JONES (West Bromwich).

My Journey from Agra to Mussoorie

It was about 4 o'clock in the afternoon when I settled down in a compartment on an express train at Agra, when on my way back to school at Mussoorie, the famous India hill station. Delhi was the first important stop, and there were many things of interest on both sides of the line. For a short time I found it great fun to watch an omnibus running on the Grand Trunk Road alongside the track. At first this travelled more quickly than the train, but eventually was compelled to wait at a level crossing till we dashed past. At times a herd of deer sauntered and crawled along about half a mile away; at others a lordly peacock and his less gaudy mate retreated hastily from the track; and many villagers returning tired from the fields to their homes also were to be seen.

During the journey I also saw in operation a curiously primitive method of drawing water for irrigation purposes. A rope was slung over a pole mounted above the well. To one end of this rope a leather bucket was attached, and the free end was hauled by two bullocks, driven by a chokra, or small boy, who urged the stubborn animals on by twisting their tails. When the bucket came up from the depths of the well, the bullocks stopped and a man emptied the water into a trough, from which it drained into the fields.

One of the narrow winding streets of the Moorish quarter of Tetuan. The donkey on the right appears to be grossly overloaded!

We arrived in Delhi about nine o'clock in the evening, to find the station a maze of sparkling and twinkling lights. The next big station on the way was Moradabad, a large junction where the climb up into the hills really begins. There another engine was hitched on at the back of the train.

We travelled on through the night, and when the Sun rose next morning every object had a dewy freshness about it and the train seemed to pick its way between pools of water. The inhabitants of the khaki mud villages on the lineside were emerging to begin their daily work and the hills themselves were in sight. In the distance was Mussoorie. I alighted at Dehra Dun and travelled by car to Rajpur. The journey may be completed on foot, on horseback, or in a dandy, a kind of litter provided with a hood and carried by coolies. These bearers are thin, but strong and wiry, and easily carry a man over the seven miles from Rajpur to Mussoorie. Each method has its own attractions, but in my case the pleasure was mixed with thoughts of school! J. FITZPATRICK (Mussoorie, India).

Yo-Yo in Ancient Greece

The Wonderful Story of a Popular Toy

A remarkable feature of many well-known games is the existence of seasons during which they are specially in favour. There are of course obvious reasons for this in the case of such games as cricket and football, but it is a little difficult to understand why any particular time should be regarded as pre-eminently suitable for games that might just as well be played almost throughout the year. For instance, there seems to be no good reason why the approach of Shrovetide should invariably bring a revival of top-spinning, and battledore and shuttlecock, two ancient games that are then played with great enthusiasm by the younger generation. There is something really remarkable about the suddenness with which these two games arrive and disappear.

In addition to games that are definitely seasonal, there are others that have recurring outbursts of popularity, sandwiched between periods of complete neglect. Take diabolo, for instance. A few years before the War there was great enthusiasm for this game, and the whirling bobbins thrown into the air from tightly-stretched strings were to be seen in practically all parts of the civilisedworld. The craze died away almost as quickly as it began. Recently renewed interest has been shown in it, and it is possible that the toy may become as popular as it was 20 years ago.

The yo-yo in ancient Greece. Our illustration, which is reproduced from a vase-painting in the Berlin Museum, shows that this popular game was played more than 2,000 years ago.

An even better example of a toy that has been alternately popular and neglected is the yo-yo. At the present time it is impossible to walk far through the streets or public parks without seeing some youthful yo-yo enthusiast busily engaged in "Walking the Dog," trying to "Loop the Loop," or absorbed in efforts to master some other weirdly-named trick. Even grown-up people are to be seen absent-mindedly keeping the double disc tirelessly running up and down its string as they talk to one another. As compared with diabolo, yo-yo has the great advantage that it is not a public nuisance. The spinning disc is easily kept under control, whereas the diabolo bobbin, in the hands of a poor performer, was a constant source of danger to windows and to innocent passers-by.

When the yo-yo first appeared in recent months it was welcomed as a new toy, and there was great astonishment at the discovery that a double disc of wood could be made to climb up one side of a piece of string after running down the other! Few of those who marvelled at the discovery of yo-yo experts knew that the toy was not a new introduction. Before the craze spread far, however, old people began to tell stories of the "bandalore," and revealed that the yo-yo is merely that old device under a new name.

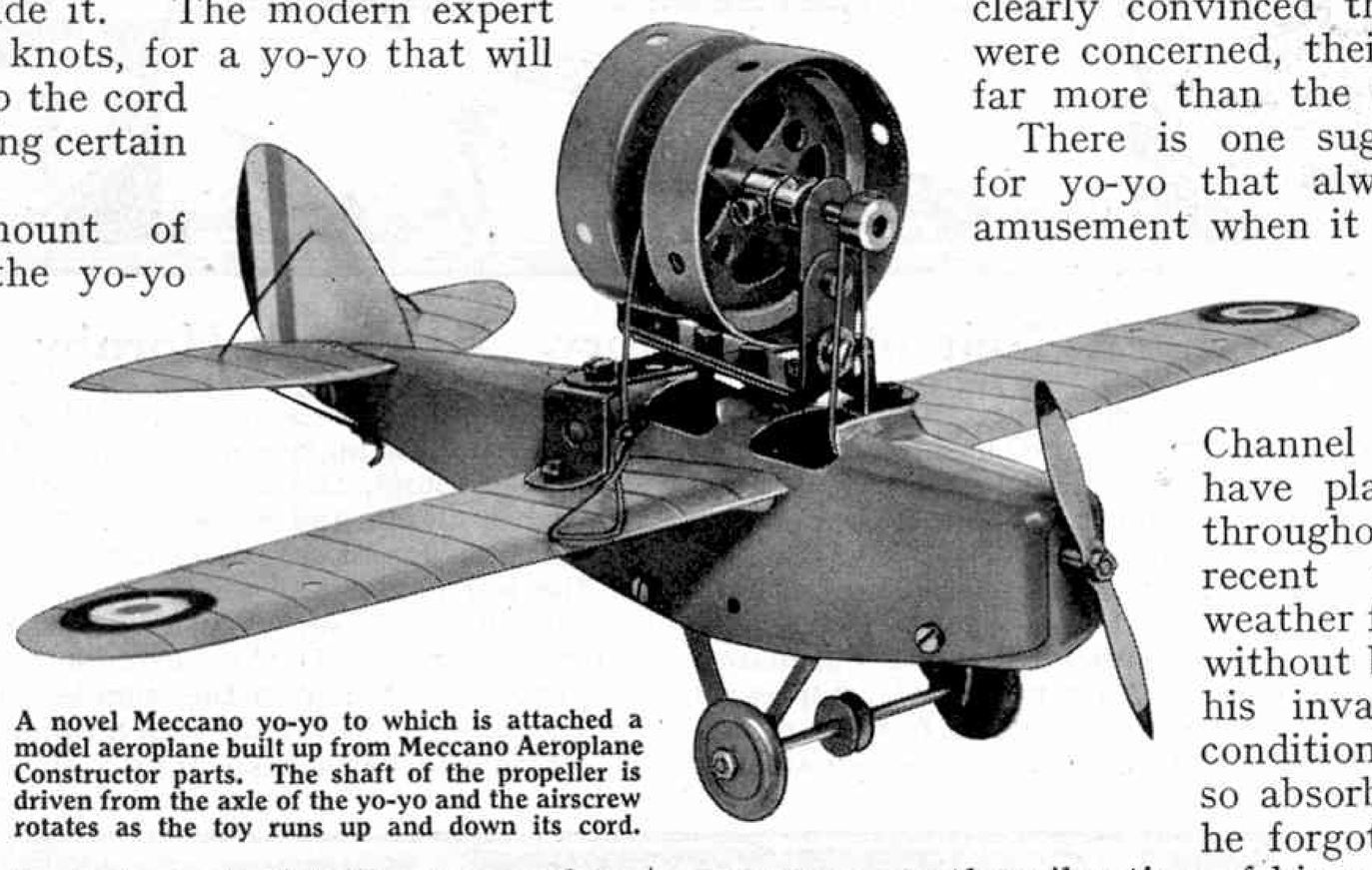
Some of those who played with the bandalore in their youth were a little contemptuous of the modern toy, and told of enormous spinning discs that ran up and down pieces of string from 25 ft. to 30 ft. in length. Chinese sailors of 40 years ago played with these monster yo-yos in Liverpool, leaning over the railings of the upper storeys of the Sailors' Home in which they lived, in order to obtain the necessary height. At least one modern enthusiast seems to have been impressed by this story, for recently a Liverpool boy was seen perched on the top of a hoarding 20ft. in height, successfully retrieving his yo-yo after allowing it to run down almost to the ground.

As the yo-yo craze spread, many interesting recollections of the bandalore came to light. For instance, it was recalled that soldiers entraining for the Crimea in 1854 often whiled away long hours of waiting on station platforms by playing with the toy. Its story as far as this country is concerned was then traced back to the arrival of emigrants from France towards the close of the 18th century. These emigrants had been accustomed to the bandalore at the French Court before the Revolution that led to their exile, and prints are still in existence showing nobles of that time manipulating the "Roial Bombon," as the yo-yo was then called. The bandalore was not exclusively a French possession during the 18th century, however, for even then it was well known in Great Britain. It was referred to by Horace Walpole, who thought it a Turkish game, and a cartoon of 1791 shows no less a personage than George IV, then Prince of Wales, amusing himself with it.

A curious misunderstanding appears to have arisen during last century in regard to the bandalore, for in the Oxford dictionary it was described as a toy containing a coiled spring that was said to be the cause of its peculiar motion. The modern expert does not use a spring, of course, and as far as can be seen from the examples that are known to us of the bandalore of 100 years ago, former exponents of the art also employed a simple string and relied entirely on a timely

jerk to make the double disc begin its upward climb. One remarkable bandalore made about 120 years ago is of ivory and consists of two discs each beautifully carved on its outer face. These discs are joined together by means of a short length of brass tubing, and the end of the string passes through a hole in the core and is knotted inside it. The modern expert employs a loop without knots, for a yo-yo that will spin without climbing up the cord is a necessity in performing certain popular tricks.

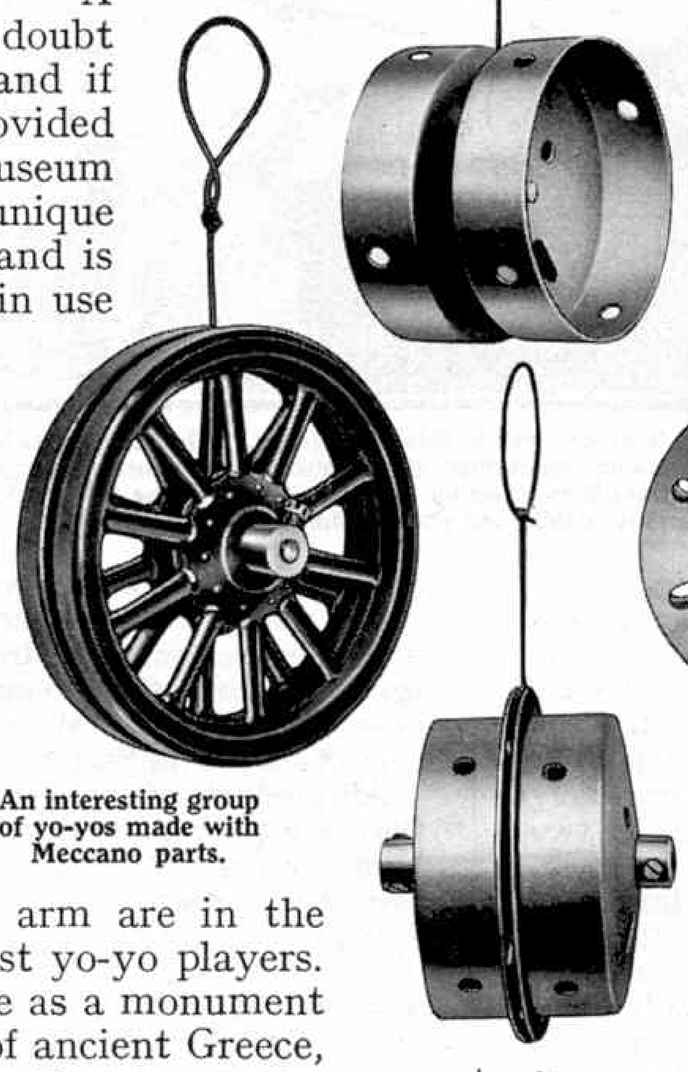
The remarkable amount of attention focussed on the yo-yo during its latest outbreak has resulted in its history being traced back far beyond the 18th century, and the astonishing fact has been revealed that the game is more than 2,000 years old. This is proved by the appearance in ancient Greek vase paintings of figures playing with the yo-yo, and of representations of what undoubtedly are early forms of the toy itself. One of these paintings, from a vase in the Berlin Museum, is reproduced here, and it will be seen that the lady portrayed is manipulating the yo-yo in the approved fashion of a modern expert.



A novel Meccano yo-yo to which is attached a model aeroplane built up from Meccano Aeroplane Constructor parts. The shaft of the propeller is driven from the axle of the yo-yo and the airscrew rotates as the toy runs up and down its cord.

Another striking example comes from an ancient vase preserved in the National Museum at Athens. The paintings on this reveal the actual form of the Greek yo-yo, for they show two sides of a spinning double disc decorated with illustrations of Greek mythological stories, while between these is a well drawn cross-section of the toy. A glance at this painting leaves no doubt of the antiquity of the yo-yo, and if further proof were needed it is provided by the presence in the Athens Museum of an actual ancient yo-yo. This unique specimen is made of terra cotta and is about the same size as the toys in use to-day, the only difference being that it has a thicker connecting bar.

There is an ancient Greek statue in which an athlete is represented with his hand outstretched, palm downward. It is clear from his attitude that he is not throwing or catching a ball, or holding anything heavy, and his pose remained a mystery until the recent revival of the yo-yo. Then it was realised that his hand and arm are in the exact position adopted by the best yo-yo players. Perhaps we may regard the statue as a monument to some famous yo-yo champion of ancient Greece, whose name has long been forgotten.



An interesting group of yo-yos made with Meccano parts.

As is the case with many other recreations, yo-yo has its amusing side. For instance, a minor tragedy is said to have occurred at York during the meeting of the British Association last August. One version of the story is that a famous scientist on his way to one of the meetings stopped to explain to a group of children exactly why their yo-yo's behaved in the almost miraculous manner seen when certain tricks are performed. Unfortunately for himself, he decided to round off his discourse by giving a demonstration. This proved to be a complete failure and in silent contempt the members of his audience dispersed, clearly convinced that as far as results were concerned, their practice was worth far more than the scientist's theory.

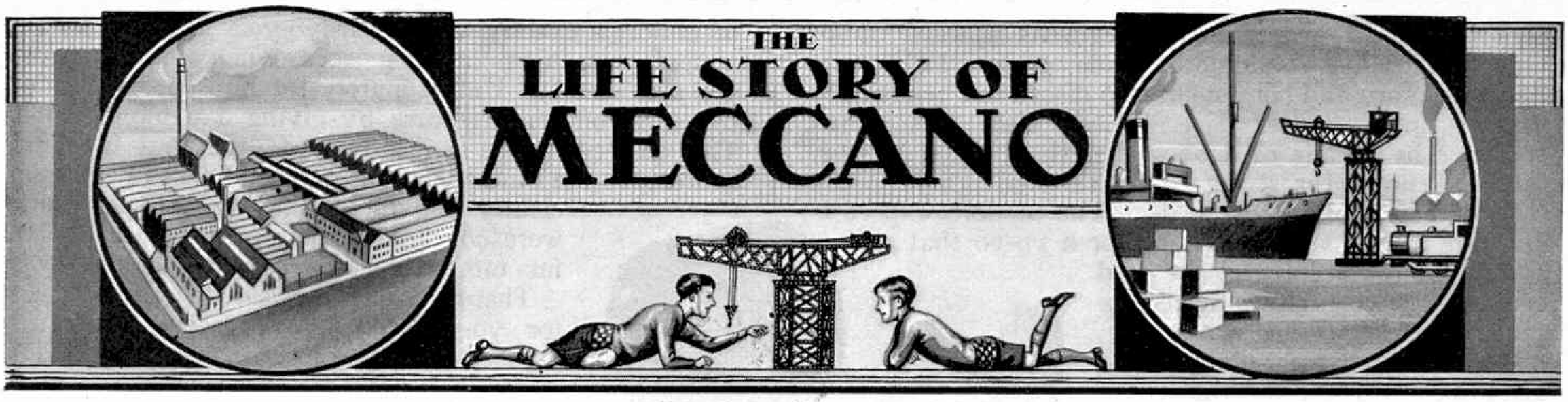
There is one suggested practical use for yo-yo that always seems to cause amusement when it is mentioned. This is its employment as a cure for sea-sickness. A passenger in a Channel steamer is said to have played with his yo-yo throughout the whole of a recent voyage in stormy weather from Ostend to Dover without being sick, which was his invariable fate in such conditions. Either he became so absorbed in the game that he forgot to follow his usual custom, or the vibration of his arm and body opposed and neutralised the roll of the ship. Whatever the cause of his immunity, a yo-yo will be an indispensable item of the luggage of all who travel overseas if the claim proves to be well founded!

The lower illustration on this page shows a group of Meccano yo-yos. These are easily made from standard parts and all give excellent results. The upper one consists of two Boiler Ends separated by means of a Washer and secured by a Nut and Bolt. Some readers may find it a little too light, and this difficulty may be overcome by placing a 1" Loose Pulley inside each Boiler End, substituting a 1" Screwed Rod for the Bolt. This form of yo-yo is very lively indeed, and is particularly suitable for trick performances.

The remaining models require little explanation. The one on the left is built of two Artillery Wheels mounted on a $1\frac{1}{2}$" Rod, and that on the right is made from Face Plates fitted on a 1" Rod. The lower yo-yo consists of two inside Discs formed by Face Plates, with a Boiler End held in place on the outside of each by means of a Collar.

All four models give the best results when the special yo-yo string that may be purchased at toy shops is used. The loop of this string is formed without a knot. The yo-yo to which it is fitted can be made to rotate freely when it reaches the end, and a slight upward jerk causes it to begin its run up the string back to the hand.

An excellent yo-yo string may readily be made from Meccano Aeroplane Cord. A length slightly more than double that of the cord required is doubled back on one end of the cord. The loop is then formed by twisting the doubled end, either by hand or by means of a Meccano Motor, the free ends meanwhile being held firmly.



XI.—A Tour of the Factory. By Frank Hornby

I CONCLUDED the previous instalment of my story by stating that the Enamelling Department might be considered the most interesting of the Finishing Departments. This department demonstrates most effectively the smooth organisation that is a feature of the Factory and, what is of equal importance, the fact that a " messy " job can be carried out without sacrifice of cleanliness and efficiency.

The Meccano parts treated here are spray enamelled, the enamel being forced from spraying " pistols " by means of compressed air. The enamel leaves the pistol in the form of a fine cloud, and it is this fineness that enables us to secure the even and smooth finish that is characteristic of our parts. For convenience of handling, the parts are spring clipped on to frames that are drawn by an endless chain through two spraying booths, placed side by side but facing in opposite directions. In the first booth one side only of the frame is sprayed, and the frame then travels on to the succeeding booth for the other side to be finished. After passing through the spraying booths the frames, complete with parts, are transferred from the spray conveyor on to the racks of the conveyor in the enamelling oven. These racks move through the oven on endless chains that completely circuit the interior of the oven, returning to their starting point in from two to 2½ hours, throughout which time the sprayed parts are subjected to varying temperatures ranging up to 220°F. On removal from the oven the parts are stripped from the frames and placed in trays and boxes to be taken to the Meccano Packing Room.

The system of line conveyor work is made clear in this photograph. On the nearest belt a variety of articles are being assembled, including turntables, signal boxes, level crossings and locomotive tenders. The assembly of locomotives is in hand on the second belt. The test tracks referred to in the article are plainly shown.

In the case of Hornby products the actual spraying operation is carried out in precisely the same manner, but the delivery to the operators is achieved in a different way, because these articles are not so suitable for the system of operation just described. The parts are placed on wire mesh frames and laid on travelling trays suspended from an endless overhead conveyor that completely circuits the department. The spraying booths are placed in two rows facing one another with the conveyor passing between. The operators working in the spraying booths take the frames of parts from the trays, completely spray them, and replace them on the next convenient passing tray. In its journey round the department each tray passes the operator engaged in loading and unloading the enamelling oven, and at this point the frame of parts is lifted off and placed on the chain conveyor in the oven. Any frame of stoved parts that has just left the oven is placed on the empty tray, which continues its journey to an unloading point for finished goods. As the tray travels along it is emptied, and then continues its journey round the department back to the point at which it was originally loaded with parts to be sprayed.

Two interesting automatic spraying machines are to be seen in this department. Parts to be sprayed on these machines are mounted on upright metal spindles, about 12 in. in length, located on the outer edges of a turntable approximately 4 ft. in diameter. The spraying apparatus consists of three nozzles. As the turntable moves round, the spindles are successively brought into contact with a clutch and made to spin rapidly. Synchronous with this rotation jets of spray are forced through the nozzles, the path of the jets converging on the work. The spinning of the part presents its whole surface to the paint for a time sufficient to secure an even coating. As the turntable continues its circuit the sprayed parts are lifted from the spindles and placed on a wire mesh belt travelling endlessly through a tunnel oven 83 ft. in length, through which the parts take approximately two hours to travel.

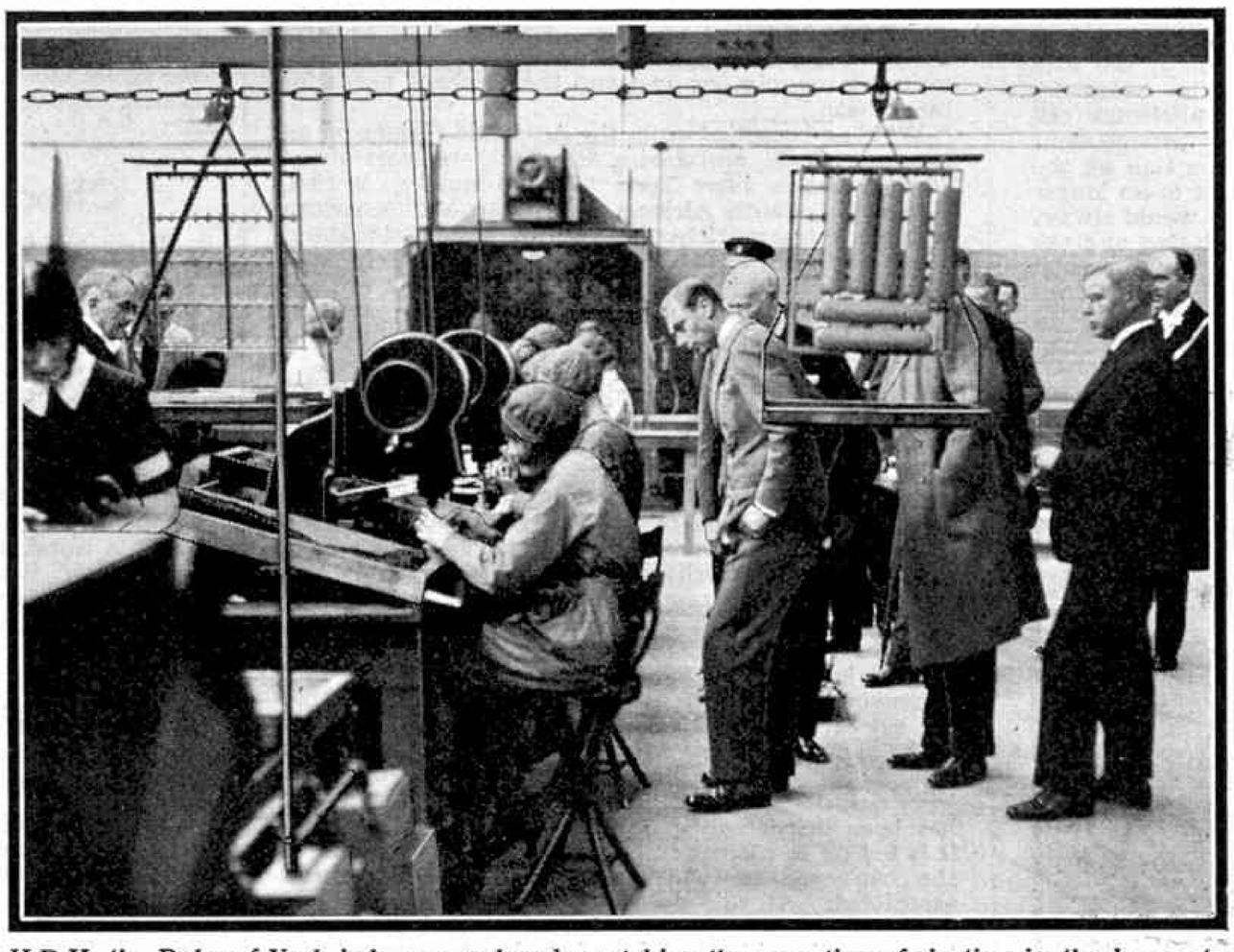
An interesting example of finishing work may be followed when the spraying of pulley wheels is in progress on these automatic machines. After the spraying and stoving the wheels pass on to a bench fitted with a belt conveyor, at which sit a number of operatives. In the first operation the boss is riveted into the pulley wheel and replaced on the belt, to be carried along for the second operation. In this the wheel is tested for concentricity and to ensure that the hole in the " boss " is of standard size. If the wheel is passed as true it is replaced on the belt and passes to the third operation, the fitting of a set screw into the boss. This is done with the aid of a mechanical screwdriver, a tiny machine consisting of a crossbar mounted over two springs, and a screwdriver turning rapidly in a slot cut in the edge of the crossbar. The set screw is dropped into this slot, head downward, and the screwdriver engages with it. When the boss of the pulley wheel is placed over the slot and the crossbar forced down, the set screw is driven into position. Finally the wheel is tested a second time to ensure that the boss is firmly riveted, and after passing this test successfully it is packed in readiness for conveyance to the Stores, and subsequently the Packing Department.

All products of the Meccano Factory are guaranteed, and before they are packed they must be inspected to ensure, as far as is humanly possible, that nothing faulty leaves the Factory. In the preceding paragraph I have given an insight into our inspection system, but many parts do not lend themselves to inspection as part of the finishing process, and these are dealt with in a special inspection department. In this large numbers of trained operatives are employed to scrutinise and gauge the parts as they come from the production departments. The work involved is enormous, and a simple illustration will make this clear. Our average daily production of Nuts and Bolts is over 115,000, and every one of them has to pass an inspector. This is but one item in the department's daily work !

After passing satisfactorily all the tests applied in the Inspection Department, the parts are ready for assembly in the case of Hornby Train components, or packing in the case of Meccano Parts, and are sent to the Stores until required for those purposes.

The packing of Meccano Outfits is a matter that can be left until a subsequent stage of my story, and our tour of the Factory now leads us to the Train Room, a department some 16,000 sq. ft. in area divided by a main central gangway, running parallel with which are numerous work benches of the conveyor type. The conveyors on the south side of the main gangway are used for the assembly of rails, hand finishing of sprayed components—such as locomotive housings—and the assembly of units such as clockwork mechanisms. These parts of the locomotive subsequently pass to the conveyors on the north side of the gangway, where the final assembly is carried out.

The principle of operation is substantially the same in all the conveyor work. The components of the article to be assembled are placed on the conveyor at predetermined time intervals and, as they travel along, the various assembly operations are carried out by the workpeople seated alongside the conveyor. Each operative concentrates on one operation—in some cases two—and gradually the article assumes its finished form and finally is examined, tested, wrapped, placed in its carton and laid on another conveyor to be carried to the Stores.

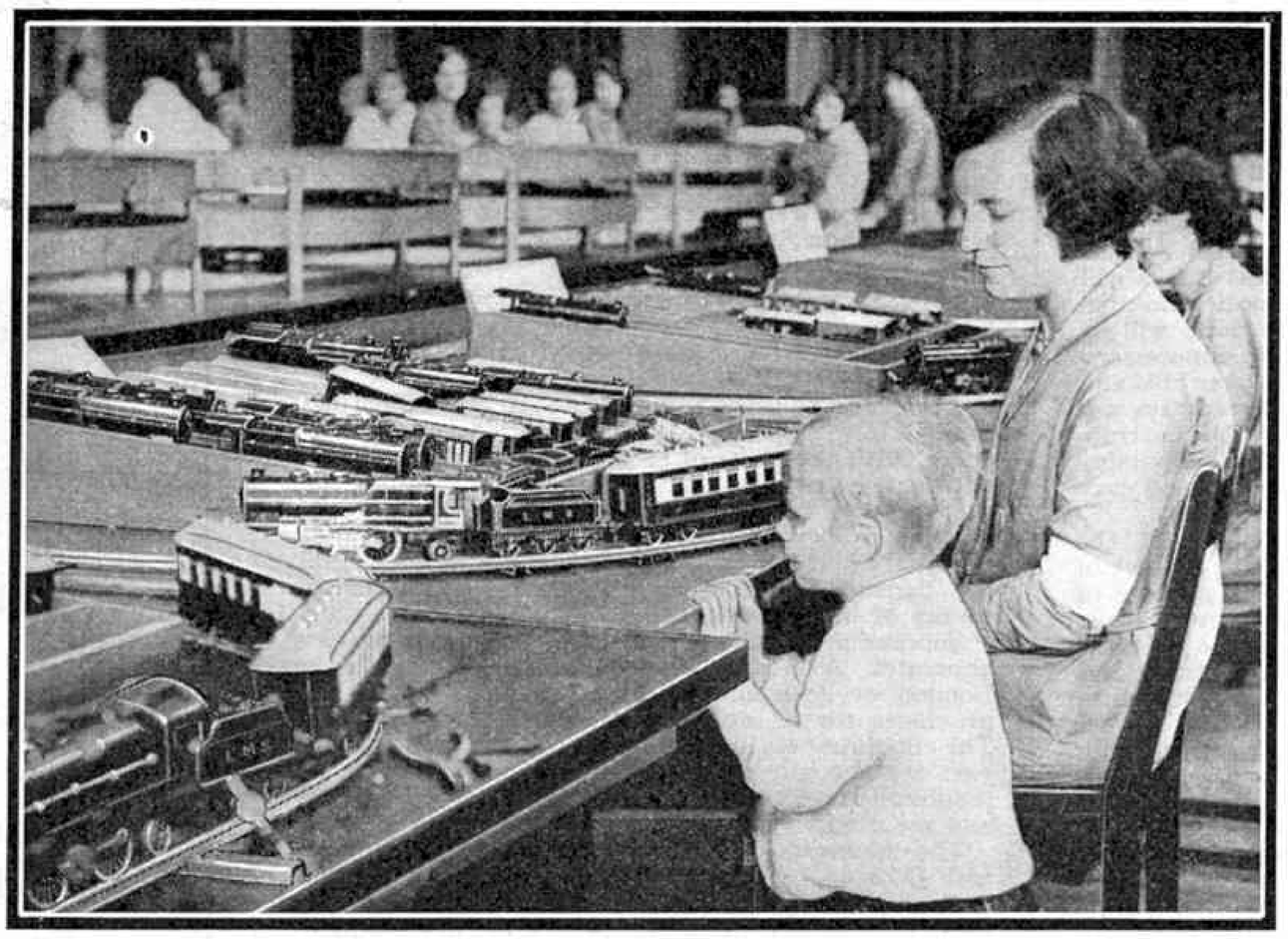


H.R.H. the Duke of York is here seen keenly watching the operation of riveting in the bosses to the pulley wheels after spraying, an operation described on the opposite page. Some of the travelling trays that circuit the Enamelling Department can also be seen in this illustration.

Some exceedingly interesting demonstrations of the care and skill that go to the making of Hornby Trains may be obtained in this department and as an example I select the finishing of a No. 1 Tank Locomotive.

Actually the preliminary assembly of the components of the locomotive housing, prior to enamelling, is not carried out in the Train Room. Obviously it would be wasteful administration to take the components from a Stores adjacent to the Enamelling Department to the Train Room for assembly, then to the Enamelling Department for spraying, and back to the Train Room for hand finishing. The assembly is therefore carried out in juxtaposition to the Enamelling Department.

The components of the locomotive are placed on the belt, and the assembly operations in sequence are as follows:—fixing the couplings; mounting the pillar bolts on the framings for the motors; fitting the wheel guards to cylinder boxes, the cab fronts to the cab sides, the cabs to the boilers and the wheel splashers to the cab and boiler sides; mounting the cabs and boilers on framings; pressing on the buffers, and finally inspection of the complete housing before passing it to the degreasing and enamelling processes. These have been described in an earlier part of this series, and the locomotive may now be followed to the Train Room itself.



A young visitor to the Factory takes a close view of the testing of a No. 3 locomotive.

The locomotive is placed on the Handpainting and Transferring line conveyor, and as it travels along the transfers bearing the locomotive number and the railway company's identifying lettering are trimmed to shape, painted with gold size and laid on the belt alongside the locomotive. The first two operations are fixing the transfer and floating off its paper backing. These processes need not be described in detail, because the underlying principle is familiar to every boy who has stuck a transfer on the back of his hand.

The next operation is the lining of the boiler with its circular bands of colour, and then in succession the painting of the buffer beams, the steps to the footplates, the chimney, the smoke-box, steam pipes, cab roof, and the whistle or safety valve cover. These involve several different colours, each being applied by a different operator; and finally the locomotive travels into the Varnishing Department, where it is placed on a dwell conveyor that carries the parts slowly along while the recently applied paint dries out. The Varnishing Department is a small but important section located in the south west corner of the Train Room. An elaborate air-conditioning plant is employed to extract every particle of dust from the air in the room, for dust must not be allowed to come in contact with newly varnished goods, otherwise the highly glossy finish would be ruined. The varnishing and subsequent stoving operations are carried out in precisely the same manner as in the enamelling process.

Simultaneously with the hand finishing of the housings the clockwork motors for the locomotives are assembled on an adjacent conveyor. In this work sets of components, other than the spring, are collected from bin racks located at the feeding end of the conveyor, placed in a metal cylinder, and laid on the conveyor. As the cylinders pass the operatives seated at the belt they are lifted off, and the whole of the mechanism of the motor is assembled by one operator. The mechanism and the locomotive driving wheels are replaced in the cylinder and laid on the belt to travel along to the operator responsible for winding in the springs. Owing to the cumbersome nature of the strips of spring steel these are laid in troughs over the winding machines, ready for use, and are not sent along the conveyor with the remainder of the components.

Finally the driving axles projecting from the side plates of the motor are stamped in a press to provide a keying for the wheels, which are pressed on in the next stage of the assembly. The finished motor now travels on to the end of the conveyor, where it is placed in a receptacle in readiness to be transferred to the conveyors on the north side of the Train Room. The empty cylinder is placed on a chute and runs back to the feeding point in readiness to restart its journey.

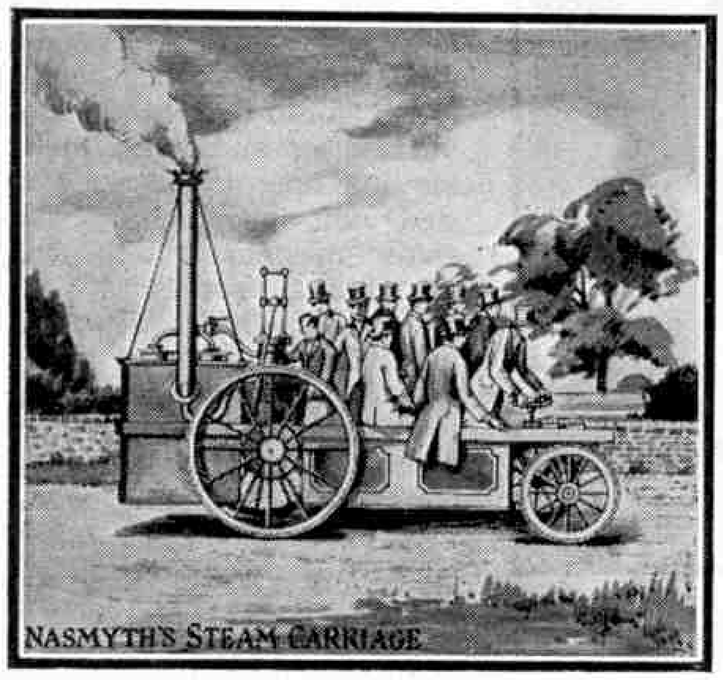
The assembly of the motor and housing involves further conveyor work. As the two units travel along, the reversing and brake levers are fitted to the motor and the hand rails to the locomotive boiler, and finally the motor is bolted into the housing. The conveyor carries the locomotive to the test tracks, at which are seated a number of highly skilled operatives whose work it is to assure themselves that mechanically the locomotive is up to specification for performance. Naturally the standards specified vary according to the class of locomotive under test, but in all cases the test involves pulling a load of rolling stock equivalent to that with which the locomotive is packed for sale.

If any minor adjustment is found necessary the tester makes it immediately, but major adjustments (*Continued on page 952*)

Trackless Railways—(*Continued from page 911*)

provide means of support for the cars at stations, of course, and platforms on which these would stop would be erected at intervals. The cars themselves would be carefully streamlined in order to reduce air resistance.

As was the case on Bachelet's electric railway, current would only be switched on in each solenoid as a car approached it. In Bachelet's model this was effected by means of trip gear on the guide rails, but relays brought into action by the interruption of a beam of infra-red rays may now be used, the cars themselves momentarily cutting off the beam by passing between its source and the photo-electric cell on which it falls. A similar switching arrangement may be introduced for the purpose of cutting off the current in each solenoid in turn when it is no longer needed. If this plan were adopted there would always be an active solenoid ring ahead of each car, and the constant forward pull thus exerted on it would cause it to move like a rocket or a projectile with a speed that might reach 600 m.p.h.



A steam-driven road carriage built about 1827 by James Nasmyth, the famous engineer. It was capable of conveying eight persons.

In order to stop a car it would be necessary to cut off the current in the solenoid immediately ahead of it. Radio would be employed to keep drivers of cars in touch with the power station, and a signal to stop the current could easily be given to the engineer in charge. Cars also could be stopped automatically, the beam of invisible light and the photo-electric cell concerned being placed at such a distance from the stopping place that the car would come to rest exactly on the platform provided. If for any reason a stop were not to be made at a certain station, a wireless message would instruct the engineer to make the automatic cut-out inoperative.

Experimental work on a large scale will be necessary before an electro-magnetic line of this kind can become a reality. If the system is successful, however, the long and heavy trains that now grind their way at comparatively low speeds over costly steel tracks will be replaced by cars built of light alloys shooting through a succession of giant solenoids. These units will be supported on trestles, and since it will be unnecessary to provide a level route, the line will run over hills and even over mountain passes. Rivers and roadways will no longer be obstacles to be overcome by the construction of expensive bridges, for the trestles supporting the solenoid rings will be of standard design and easy to build in suitable positions.

Travel on the electro-magnetic air lines of the future will be luxurious as well as safe, for the use of light alloys in building the cars, and the absence of heavy machinery, will give the designer more scope than he has at present. The motion of the cars will be smooth and easy, and they will be warmed and heated by means of current picked up from wires along the track.

The advantages of the system will be greatest in cold regions or mountainous countries, for the solenoid rings will be heated by the passage of current through their windings, and thus will be unaffected by ice and snow, two dreaded enemies of railwaymen in many parts of the world. A great network of electro-magnetic lines may thus be built up, crossing Arctic lands, deserts and mountain ranges when necessary to shorten routes.

A Useful Toilet Fitting

The makers of Brylcreem have placed on the market a special pump to simplify the dressing of the hair. By pressing the plunger fitted to the pump a supply of Brylcreem is automatically delivered into the hand. There is no need to remove the cap and shake the cream out; the pump does it in an instant.

The pump is chromium-plated and is easily transferable from one bottle to another of the same size and will last a lifetime. The low price is 1/6.

Romance of Whaling—(*Continued from page 925*)

in the vessel. The blubber yields the finest quality of oil, that from the other parts of the carcase varying in quality.

When the floating factory has obtained a full cargo, and in any case before the ice sets in, she returns to her home port, but the whale catchers do not come further north than Buenos Aires, lying up in this or some other South American port until it is time to return to the Antarctic for the next whaling season. The floating factory again goes south in time to meet the catchers, taking with her sufficient fuel and provisions to supply her own and the catchers' needs for the season.

Whaling is carried on in the Antarctic regions on an enormous scale, and during the past few years about 20,000 whales have been killed annually, British, Norwegian, South African, Australian and American whaling ships participating in this terrific slaughter. It is impossible to say how long the supply of whales will enable this high rate of killing to be kept up, but certain interested countries are already investigating the subject with a view to taking steps to avert extermination of the whales in this region.

Life Story of Meccano—(*Cont. from page 951*)

involve the complete rejection of the locomotive, which is replaced on the belt with a report attached to it stating the reason for rejection. Locomotives that pass satisfactorily are ticketed accordingly and travel along for wrapping and packing.

While the assembly of the locomotive has been going on, the assembly of the train set with which it is to be packed has been in hand simultaneously on another conveyor. In this operation the box, containing only the set of assembled rails, is placed on the convevor with the components for the rolling stock. The assembly is carried out stage by stage in the manner I have described, and after the individual rolling stock has been inspected, wrapped and placed in the box, it is fed on to a cross convevor that passes the end of the conveyor on which the locomotive has been assembled. At this point the locomotive is packed in the box, the necessary literature and guarantee forms are placed in the lid, and the box is wrapped and replaced on the belt to travel to the Stores.

In this description of the assembly of a train set I have necessarily had to confine myself to a brief outline, but it will be seen that there is an amazing amount of work accomplished. Actually in the making of a No. 2 Special Train Set there are 2,732 operations involved! In the next part of my story I will deal with the packing of Meccano Outfits and the final despatch of the goods, in addition to discussing the activities of some of the departments that are engaged otherwise than on the actual production of Meccano and Hornby Trains.

For Dundee Readers

An interesting Meccano Model-building Competition is being run by Messrs. Smith Brothers of 3–15, Murraygate, Dundee. There are three sections, for boys from 7 to 9, 9 to 12, and 12 to 15 respectively: there are no restrictions as to the type of model, and there is no entrance fee. Models must reach Smiths not later than 8th December, and entry forms may be obtained from the firm.

What Shall I Be?—(*Continued rom page 927*)

age limits of 18 years and 23 years, or by competition limited to officers already in the service of the Post Office, with age limits of 18 years and 30 years. Competitions are usually held each year in the spring, and the subjects of the examination are English composition, general knowledge, lower mathematics, electricity and two more technical subjects. As usual, the personal qualities of candidates are tested by means of interviews.

Successful candidates in these competitions are appointed Assistant Superintendents of Traffic in London or Assistant Traffic Superintendents in the provinces for a probationary period of two years. The appointments involve liability to transfer from one part of the country to another in accordance with the requirements of the service and night duty is occasionally required.

The minimum pay is £184/12/– a year in London and £172/6/– a year in the provinces. Promotion to higher grades of service is by selection, and the posts of Assistant-Controller in London and Superintendent in the Provinces carry maximum salaries of £939/14/– and £564 a year respectively. Civil Service wages and salaries have been stabilised with bonus for about two years ahead, subject to certain conditions. All the figures given above represent the stabilised rates, but it should be understood that they are liable to review.

Those who are interested in any of the Post Office careers dealt with in this article may obtain leaflets giving details of the necessary open competitive examinations on application to the Secretary, The Civil Service Commission, Burlington Gardens, London, W. Further information on special points also may be obtained by writing to the Editor of the "*M.M.*," who is always pleased to give advice and assistance in individual cases.

Fun for Christmas—(*Continued from page 955*)

figure to be drawn inside, and then snaps back into place. A Cranked Bent Strip is bolted at the back of the figure and rests against the edge of the Sector Plate.

The model we have named "Professor Strongarm" is so simple that detailed instructions are not necessary. Washers are placed between the 1" Pulleys and the Angle Brackets representing the "Professor's" hands, and if these are adjusted so as to press lightly against the Pulleys, the "Professor" will describe complete revolutions as the Pulleys move along the "bars." The model should be tilted at one end in order to make the figure move. In the illustration the "Professor" is held captive by means of small elastic bands.

Chocolates for Christmas

There are few more acceptable Christmas presents than a box of chocolates, and to those who intend to make such gifts Cadburys this year offer an even wider selection than usual of beautiful boxes, varied in design and price to suit the tastes and pockets of everybody. The Cadbury quality is to be found in every item, from the simplest carton to the magnificent and costly caskets.

In these days of stern competition it is interesting to find the products of the famous Bournville factory more than holding their own against foreign rivals. Readers should note specially the remarkable series of gifts obtainable for the coupons to be found in packets of Bournville cocoa. Details of this gift scheme are available on application to the Gift Department, Cadbury Bros. Ltd., Bournville.

Result of October Competition Kay Sports Company

The names of the prize-winners in the Kay Sports Company's Competition announced in our October issue, are as follows:—First Prizes: Master Eric Fennell, 72, St. Ann's Road, Barking, Essex; Master Alfred Welland, 8, Heathfield Road, Plymouth, Devon. Second Prizes: Master John Langridge, 6, Priory Crescent, Lewes, Sussex; Master Frank Cullis, 228, Lichfield Road, Aston, Birmingham. Third Prizes: Master J. Forth, 3, Neale Street, Roker, Sunderland; Master Charles Bramfitt, 9, Lancaster Grove, Kirkstall, Leeds.

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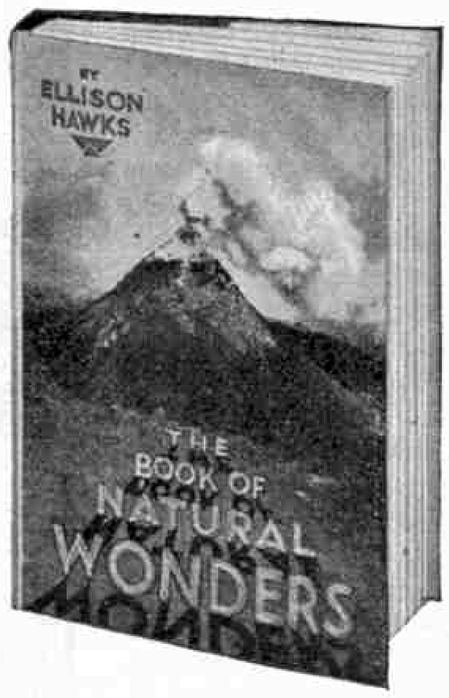

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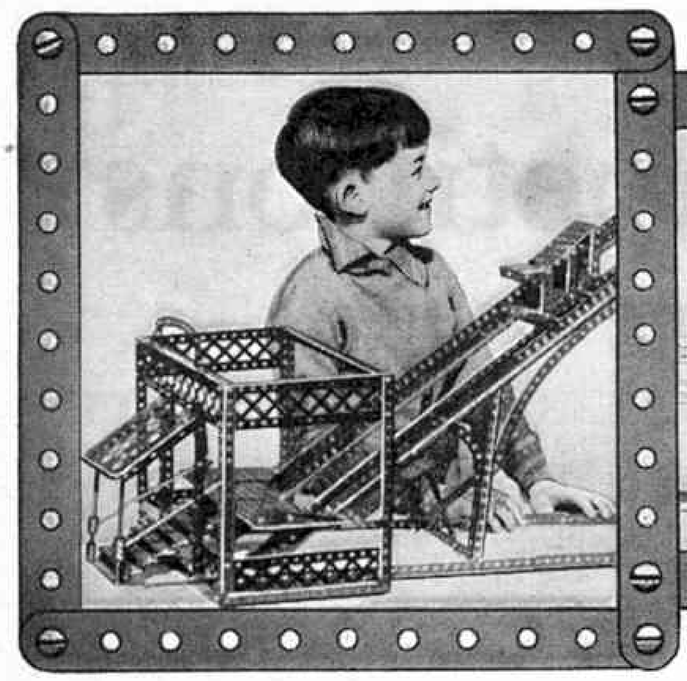
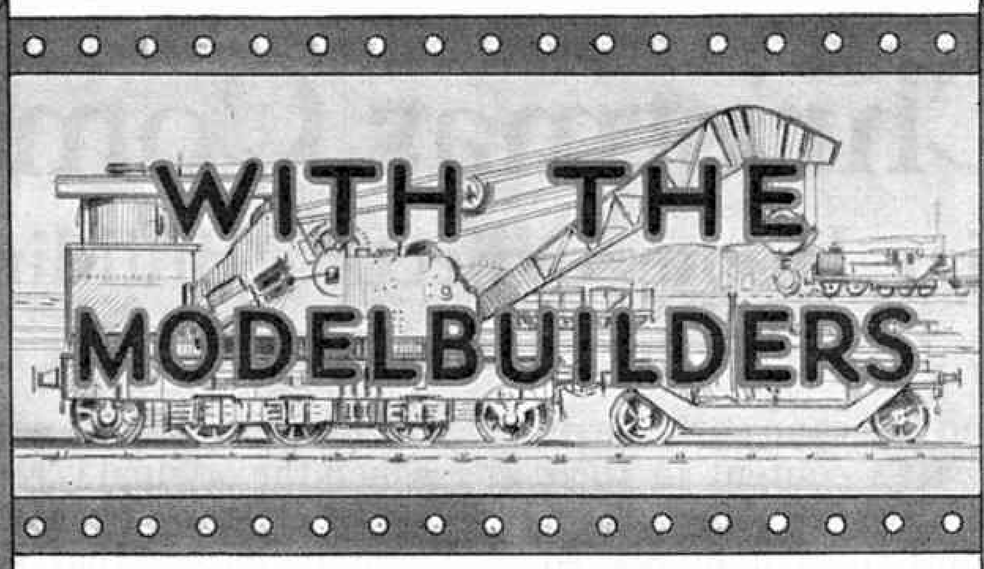
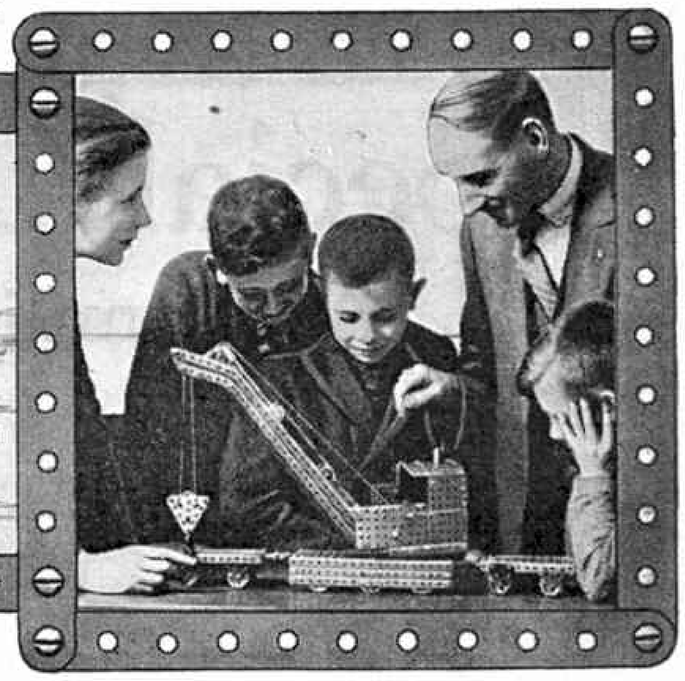






THE ANCHORING SPRING (Part No. 176)

Among the Meccano parts of recent introduction one of the smallest and most interesting is the Anchoring Spring for Cord, part No. 176. This part consists of a coiled spring, the wire of the spring being looped at one end so that Meccano Cord may be tied to it. The part is first of all mounted on the winding shaft of the crane, etc., by twisting it into position in a clockwise direction. When it is in place, the winding cord is attached to the loop, and is then locked rigidly to the shaft, there being no possibility of its slipping round the shaft when a heavy load is applied.

In addition to its use in winding gears, hoists, etc., the Anchoring Spring may be employed in a number of other ways. Boys who build model boats, for instance, often wish to fit them with davits complete with lifeboats, but find difficulty in designing suitable davits. Excellent davits can be made from short Axle Rods, bent slightly in a vice or with a pair of pliers in order to give the required overhang. An Anchoring Spring is then attached to each of the Rods, and the suspension cords supporting the boat are fastened to the loops on the ends of the Springs. Alternatively the loops may be enlarged slightly so that the suspension cords will pass freely through them. The Cords attached to the boat may then be passed down through loops on the ends of the davits to a suitable winding gear on the deck of the vessel. In this way the boat may be raised or lowered in a most realistic manner.

Meccano ship-builders who fit radio aerials to the masts of their models will also find the Anchoring Spring useful. The part may be secured to the tips of the Axle Rods forming the masts, and the copper wire or cord forming the aerial gear attached to the looped portions of the Anchors.

QUICKLY-REMOVABLE FASTENINGS IN MECCANO

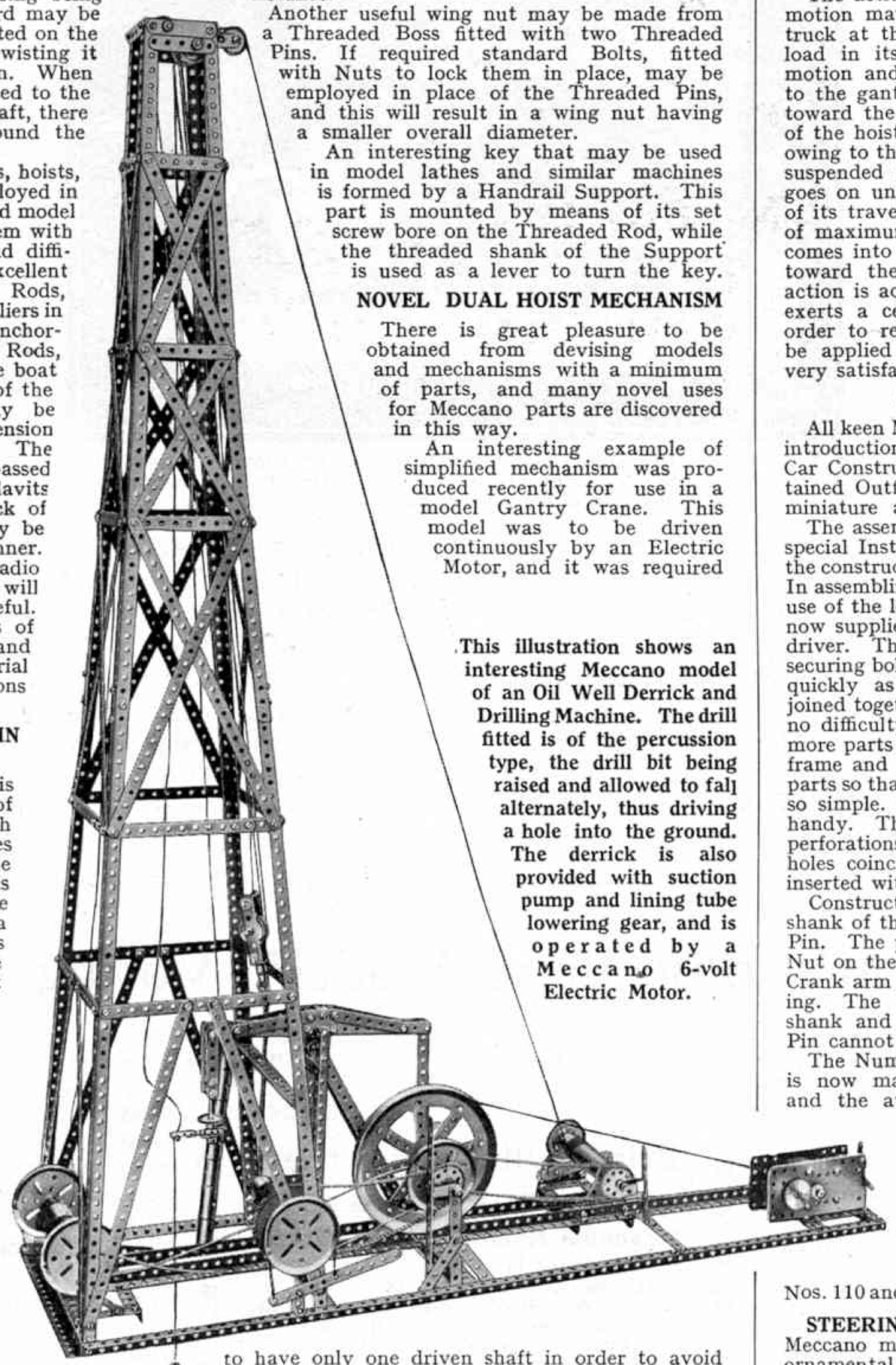
In Meccano constructional work it is usual to make a rigid joint by means of a nut and bolt locked together with Spanner and Screwdriver, but instances may be found where a quickly-detachable fitting is needed. For example, it is often required to inspect and oil the gear-box of a model motor car, and a quickly detachable gear-box cover is therefore a great asset. There are numerous methods of enabling a part to be removed quickly when required and details of some of these will doubtless prove interesting.

In models in which Plates are used extensively, and where it is required to remove one of these quickly, a simple and effective method is to secure a number of $\frac{3}{8}$" Bolts to the fixed Plates with their shanks projecting outward. The removable Plate is fitted over the shanks of the Bolts, and Nuts are screwed to the projecting shanks of the Bolts so that the Plate is held in position rigidly. It is quite a simple and speedy matter to unscrew the Nuts so that the Plate may be removed whenever required. Another method of securing a Plate in position is to mount a number of Threaded Cranks on the fixed portion of the framework. The removable Plate fits into position over the Cranks, and is held by means of Bolts that pass through the Plate and are screwed into the threaded bosses of the Cranks. To remove the Plate it is merely necessary to unscrew the Bolts, and this operation can be carried out very speedily.

The operation of removal is speeded-up considerably when the unit is arranged so that it may be removed with the fingers alone. If it is required to do this, "thumb" or "wing" nuts should be used in place of Nuts or Bolts, and several useful types can be built up from standard parts. An effective wing nut can be assembled by passing a 1" Axle Rod through the plain bore of a Collar and nipping the Rod in position by means of a Set Screw. The remaining Set Screw bore enables the wing nut to be locked on the projecting bolthead secured to the fixed portion of the model. It should be noted that owing to the Set Screw Bore in the Collar being comparatively short, the Bolt secured to the fixed portion of the model should be arranged to project for only a short distance.

Another useful wing nut may be made from a Threaded Boss fitted with two Threaded Pins. If required standard Bolts, fitted with Nuts to lock them in place, may be employed in place of the Threaded Pins, and this will result in a wing nut having a smaller overall diameter.

An interesting key that may be used in model lathes and similar machines is formed by a Handrail Support. This part is mounted by means of its set screw bore on the Threaded Rod, while the threaded shank of the Support is used as a lever to turn the key.



This illustration shows an interesting Meccano model of an Oil Well Derrick and Drilling Machine. The drill fitted is of the percussion type, the drill bit being raised and allowed to fall alternately, thus driving a hole into the ground. The derrick is also provided with suction pump and lining tube lowering gear, and is operated by a Meccano 6-volt Electric Motor.

NOVEL DUAL HOIST MECHANISM

There is great pleasure to be obtained from devising models and mechanisms with a minimum of parts, and many novel uses for Meccano parts are discovered in this way.

An interesting example of simplified mechanism was produced recently for use in a model Gantry Crane. This model was to be driven continuously by an Electric Motor, and it was required to have only one driven shaft in order to avoid complication in the coupling of the Motor. At the same time it was necessary to demonstrate both the travelling of the gantry truck backward and forward on the gantry, and the hoisting and lowering of the load suspended from the gantry truck.

The problem was solved in a simple and ingenious manner. One end of the hoist cord was attached to the forward end of the gantry, and this cord was then passed round a Pulley mounted on the gantry truck, and down to the hoist truck. The cord was next passed round the hoist block sheave, and was finally secured to a Flat Bracket fastened to the gantry truck frame. A second length of cord was now attached to the gantry truck and passed over a Pulley mounted directly over the centre pivot of the gantry. The cord was then led down to the winding drum on the operating shaft, which was coupled to the armature shaft of the Electric Motor through an automatic clutch gear.

The action of the gear is as follows. The cycle of motion may be said to commence with the gantry truck at the outer end of the gantry rails and the load in its lowest position. The Motor is set in motion and proceeds to wind up the cord attached to the gantry truck, thus drawing it along the rails toward the inner end. At the same time a portion of the hoist cord is drawn into a horizontal position owing to the movement of the truck, and the effective suspended length of hoist cord is shortened. This goes on until the gantry truck is at the inner limit of its travel, the load hook then being in a position of maximum elevation. The automatic clutch then comes into action and allows the truck to run back toward the outer end of the gantry. The return action is accelerated owing to the fact that the load exerts a certain amount of force on the truck in order to reach its lowest position. This gear may be applied to a simple hand-operated model with very satisfactory results.

MOTOR CAR CONSTRUCTOR

All keen Meccano boys will have been thrilled by the introduction of the wonderful new Meccano Motor Car Constructor and many readers have already obtained Outfits and are now experiencing the joys of miniature automobiles assembly and operation!

The assembly of the model is described fully in the special Instruction Leaflet supplied with the Set and the construction will be found to be delightfully simple. In assembling the model, constructors should make full use of the long tapered rod, termed a "drift," that is now supplied in addition to the Spanner and Screwdriver. The purpose of this tool is to enable the securing bolts to be slipped into position as simply and quickly as possible. Where two parts are to be joined together by means of the special $\frac{1}{4}$" 6 BA Bolts no difficulty will be experienced, but where three or more parts have to be held together (for example the frame and body sections) the task of assembling the parts so that the bolt holes coincide exactly is not quite so simple. It is here that the Drift comes in very handy. The Drift is inserted, thin end first, in the perforations and moved from side to side until all the holes coincide; it is then withdrawn and the Bolt inserted with perfect ease.

Constructors should also note that the screwed shank of the Nut Block is now provided with a Split Pin. The purpose of this part is to lock the special Nut on the shank of the Nut Block, so that the Bell Crank arm may be rotated without the Nut unscrewing. The Pin is pushed through the hole in the shank and the ends are bent outward so that the Pin cannot slip out of the hole.

The Number Plate shown separately in the Leaflet is now made integral with the Bumper Bracket, and the attachment of the Front Wheels on the stub axles is effected by means of the special Stub Axle Screw (Part No. A1069).

RACK BAR.—A metal bar having standard Meccano teeth cut in one edge would be useful in certain mechanisms, but its functions are covered by the $3\frac{1}{2}$" and $6\frac{1}{2}$" Rack Strips (parts Nos. 110 and 110a). (*Reply to D. Larkin, London, E.3.*)

STEERING WHEEL.—A special steering wheel for Meccano model cars would form an interesting and ornamental addition. At present we suggest that you use a Pulley Wheel fitted with a rubber ring to represent this part, or you could employ the Steering Wheel and Column (Motor Part No. A1029) from the Motor Car Constructor Outfit. This is remarkably realistic but it could only be fitted to small models. (*Reply to J. Yeats, Farnham.*)

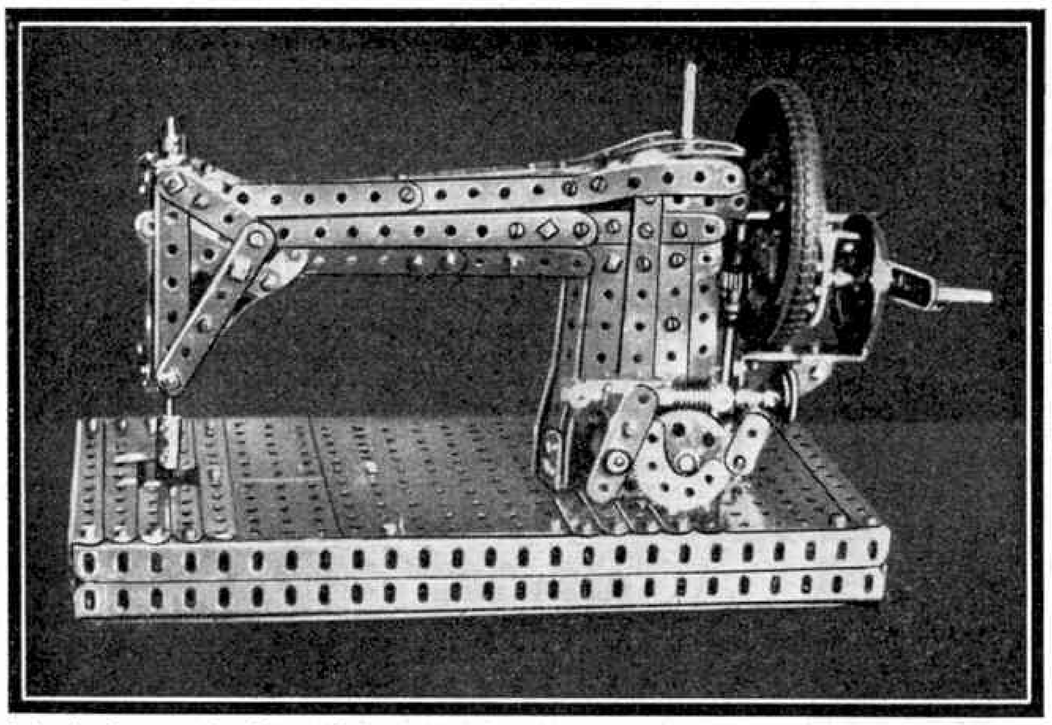
PROPELLER CAP.—A pointed boss cap for the Meccano Aeroplane Propellers would add a touch of realism to the models. In actual practice certain machines, notably high-performance military aircraft, are fitted with large coned propeller bosses, their purpose being to improve the streamline and reduce head resistance. It may be possible to introduce the parts that you suggest. (*Reply to G. Athey, Hull.*)

Special Christmas Competitions

A "Familiar Home Objects" Building Contest

The holidays will soon be here and Meccano enthusiasts will be free to indulge to their heart's content in their favourite hobby. There is generally a good deal of unpleasant weather during the Christmas holidays, so that a considerable amount of the time is inevitably spent indoors. For this reason we think it a good opportunity to organise a special model-building contest in which competitors are invited to enter models of familiar household objects.

In this competition the only restriction is that the subject chosen for the model must be one that is to be found in almost every home. This allows a very wide choice, ranging from articles of furniture, vacuum cleaners and carpet sweepers, to electric and gas stoves, and the almost endless variety of appliances and utensils to be found in every kitchen.



A typical example of a model suitable for entry in the "Familiar Home Objects" Model-building Contest announced on this page. This fine working model sewing machine is the work of E. G. Lewis, Cheltenham.

Every owner of a Meccano Outfit can take part in the competition. All that it is necessary to do is to build a model of the chosen home object, and then either to take a photograph or make a good drawing of it and address this to "Familiar Home Objects Contest," Meccano Ltd., Binns Road, Old Swan, Liverpool. There are no restrictions in regard to the size of the Outfits that may be used in building the models, and competitors may submit more than one model if they wish. Small and simple models will have just as good a chance to win prizes as more complicated and elaborate structures; the deciding factors will be the accuracy and realism with which the original is reproduced, and the skilful use made of the Meccano parts that are employed. Once again we remind readers that every part that is used in a competition model should serve a definite purpose, either of structure or ornament. A model that contains parts that are totally unnecessary has little chance of success.

When sending in their entries competitors must remember to write their age, name and full address clearly, preferably in block letters, on the back of each photograph or drawing submitted. Such photographs or drawings need not be the work of the competitor, but the model itself must be entirely the result of his or her own unaided efforts.

The competition will be divided into three sections as follows:—Section A, for competitors over 14 living in the British Isles; Section B, those under 14 living in the British Isles; Section C, all Overseas competitors.

In addition to the prizes announced in the panel on this page, the first three prizewinners in each section will receive a special certificate that they can keep as a permanent record of their success.

Competitors will have plenty of time to build and photograph their models, as the closing dates are specially extended. In Sections A and B the last day on which entries can be received is 28th February, 1933. The closing date for Section C is 30th April, 1933.

"The Year's Best Prize Model" Voting Contest

In this Contest each competitor is asked to name on a post-card:—(A) The Prize-winning model he considers the best illustrated in the *"M.M."* during 1932; (B) The six models that he believes will prove the most popular, as decided by the massed votes of the competitors in this Contest.

Only models that have been illustrated on the *"Model-building Contests Results"* pages, including the International Model-building Contest pages, in any of the issues of the *"M.M."* for 1932 are to be taken into consideration in this Competition, including those illustrated on the "Results" pages of this issue. Each model referred to must be identified by giving the page and date of the issue in which the illustration appeared, the name of the model, and that of its builder.

Entries must be by post-card only. The competitor's name and address must be written on the card, which should be addressed to "Year's Best Model" Voting Contest, Meccano Ltd., Binns Road, Old Swan, Liverpool. It should be noted that no competitor may submit more than one entry.

There will be one Section only and competitors of any age may enter. The closing date is 31st March, 1933. The list of principal prizes to be awarded to the competitors whose lists most accurately forecast the final results appears in the panel on this page.

In addition to the prizes shown in the panel, the builders of the six models chosen by the final massed votes of all competitors to be the most popular will each receive a prize of Meccano goods, value 5/–. Prize-winners may choose any goods they like from current Meccano catalogues.

In the unlikely event of two or more competitors placing the six best models in the correct order, First Prize will be awarded to the competitor whose entry is the neatest.

Before sending in their lists of models competitors must take care to see that each model is clearly identified. In cases where the builder's name does not appear in the caption to the *"M.M."* illustration it will be found in the accompanying article.

Prizes Offered in these Competitions

"Familiar Home Objects" Contest

Sections A and C.
First Prize, Cheque for £3-3s.
Second Prize, Meccano goods value £2-2s.
Third Prize, Meccano goods value £1-1s.
Five Prizes of Meccano goods value 10/6.
10 Prizes of Meccano goods value 5/–.

Section B.
First Prize, Cheque for £2-2s.
Second Prize, Meccano goods value £1-1s.
Third Prize, Meccano goods value 10/6.
10 Prizes of Meccano goods value 5/–.

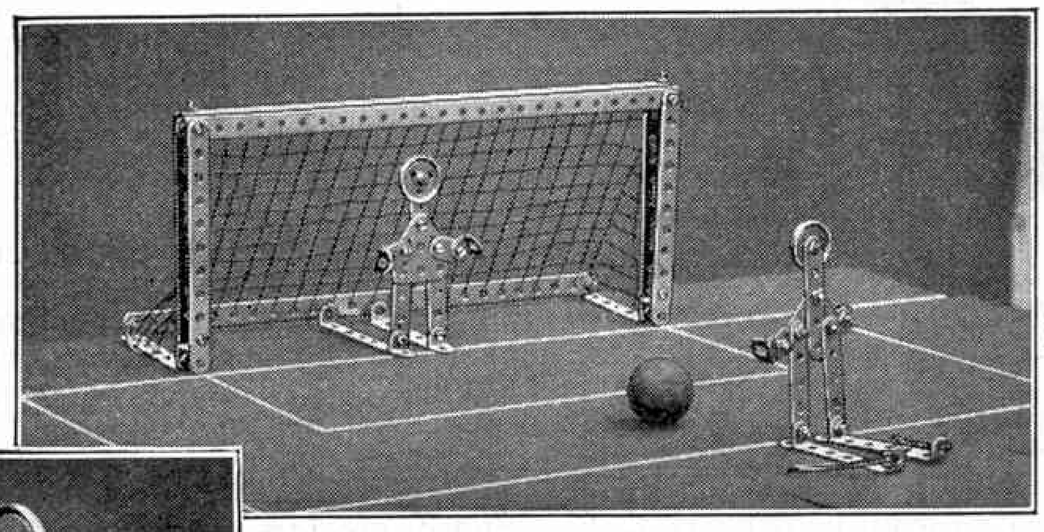
"Year's Best Prize Model" Voting Contest

First Prize, Cheque for £2-2s.
Second Prize, Meccano goods value £1-1s.
Third Prize, Meccano goods value 10/6.
10 Prizes of Meccano goods value 5/–.

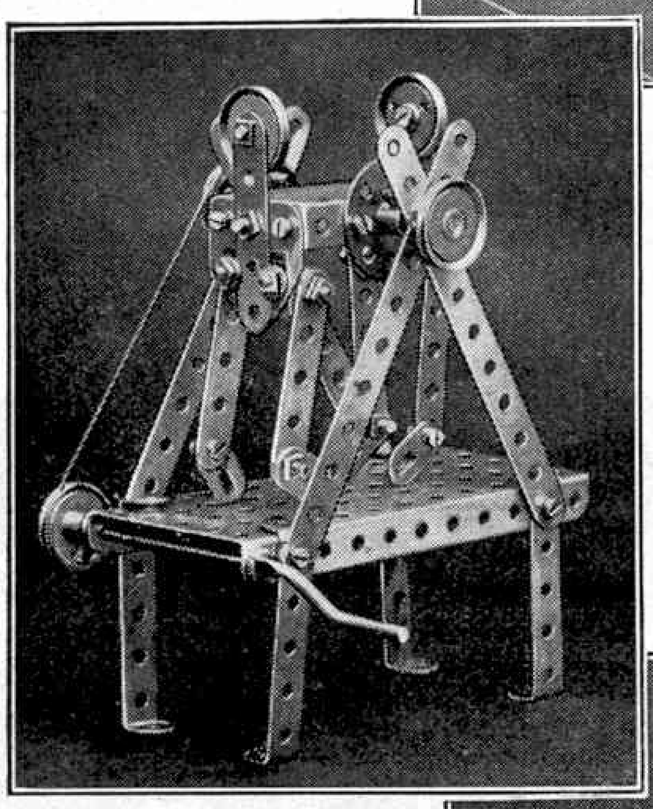
Meccano Fun for Christmas

Five Quaint and Easily Made Toys

CHRISTMAS-TIME offers a splendid opportunity for model-builders to indulge in the lighter side of Meccano construction by using their Outfits to make various kinds of mechanical toys. The simple models described in this article will provide welcome relaxation from the usual type of model-building, and also will be found admirable for amusing one's younger brothers and sisters. They are quite simple to build, and most of the constructional details are clearly shown in the illustrations.



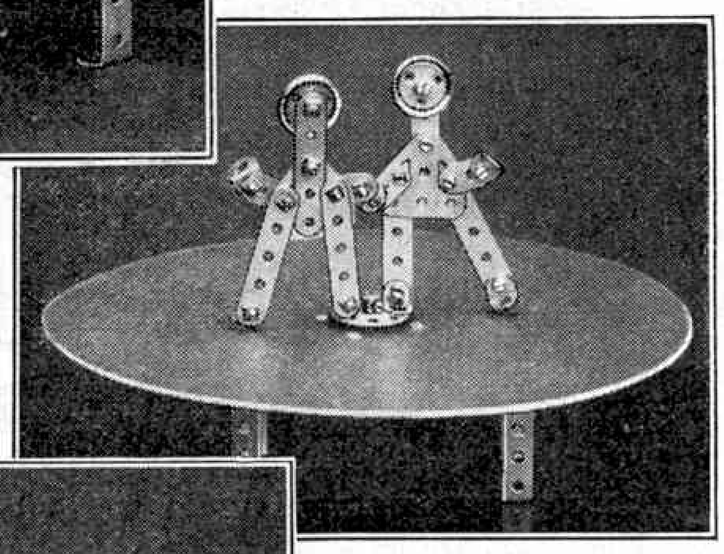
The first model is called the "Penalty Kick." Many fascinating games can be played with a complete miniature football set constructed on similar lines to this model. From the illustration it will be seen that the goal posts are made from $5\frac{1}{2}$" Strips spaced apart by Double Brackets at the top and $\frac{1}{2}$" Reversed Angle Brackets at the bottom. The cross-bar consists of three $12\frac{1}{2}$" trips bolted to the Double Brackets and a table tennis ball may be used for the football. The player taking the kick is supported by two Double Angle Strips, to the outer ends of which pieces of elastic are attached, the other ends of the elastic being fastened by drawing pins to the table on which the model stands.



To take a penalty kick, the ball is placed in front of the player, and then the elastic band is gripped by the forefingers. The figure is drawn back with the thumbs, and then released like a catapult.

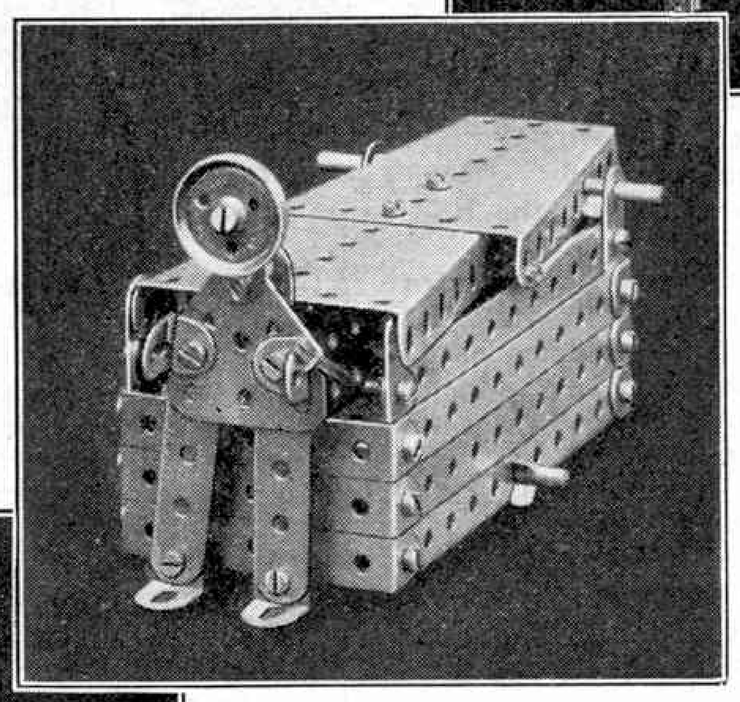
The model that we have called the "Wrestlers" is an amusing little toy and needs only a few parts for its construction. Two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips, one of which is bolted to a Bush Wheel, form the arms of the wrestlers. The legs are each pivoted to the body by means of bolts and lock-nuts. Sharp irregular movements of the Crank Handle will result in amusing antics by the wrestlers.

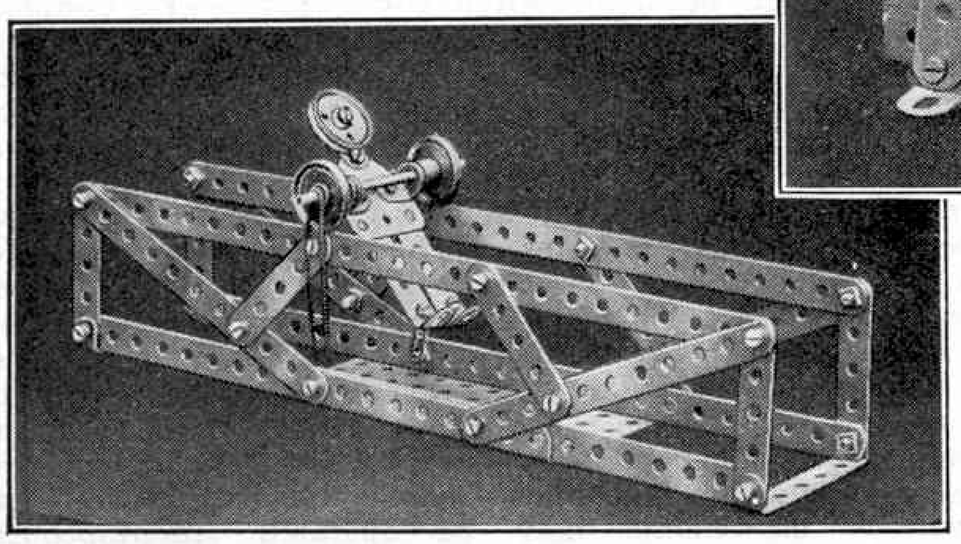
The next model represents a pair of dancers that can be made to carry out some amusing steps simply by turning a Crank Handle. The right arms of the dancers are bolted loosely together by means of a Reversed Angle Bracket. Their outer "legs" are lock-nutted to the Flat Trunnions forming their bodies. The model is operated by rotating a 1" Pulley beneath the dance-floor, which is made from a circular piece of cardboard mounted on a Flanged Plate. This Pulley is secured to a short Rod carrying the Bush Wheel on which the dancers are mounted. The Pulley is then connected by a cord to a Crank Handle, which may be suitably mounted at a distance.



All readers will be familiar with the "Jack-in-the Box" toy, and the "Disappearing Meccanitian" described here is based on this time-honoured amusement provider. The bottom of the box-like portion of this model consists of a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate, and three $5\frac{1}{2}"$ Strips bolted to upright $2\frac{1}{2}"$ Strips form each side, with three $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips for the ends. The lid, which is mounted pivotally on an Axle Rod, consists of two Sector Plates bolted together. Elastic bands are tied to the sides of these Plates, and are then connected to a Rod passed through the bottom of the box. The Meccanitian also is connected to this Rod by pieces of elastic. When the end of the rear Sector Plate is depressed the lid opens sufficiently to allow the

(Continued on page 952)





A collection of amusing and easily made Meccano toys. Commencing with the top illustration the models are as follows: (1) The Penalty Kick. (2) The Wrestlers. (3) Eccentric Dancers. (4) The Disappearing Meccanitian. (5) "Professor Strong-arm."

Suggestions Section Edited by "Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(273) Twin Coupled Electric Motors

(S. C. Buszard, London, N.3)

THE device illustrated below in Fig. 273 is intended for coupling two Electric Motors together so that the combined power of both units may be utilised for driving purposes. As soon as either Motor is stopped, however, the two are immediately uncoupled, so that the other can rotate independently. The Motors remain uncoupled if running in opposite directions. The mechanism is likely to be found of greatest utility in large models, such as cranes, with several different movements. In such cases the full power of the two units could be utilised for certain movements, especially when handling the full load. For lighter work only one power unit need be used, and other movements could be driven at the same time in reverse.

Two No. 6 Electric Motors are shown mounted on a pair of 7½" Angle Girders. Full use should be made of the elongated holes in the flanges of the Motor side plates for spacing the units at the maximum distance apart. Careful placing of the Motors is necessary, and they should be trued up by passing a long Rod through both sets of side plates. If the Rod turns freely the alignment is correct.

Each Motor armature spindle carries at its inner end a ½" Pinion that meshes with a 57-teeth Gear on a 5" Axle Rod. The two Gears are mounted with the bosses outward on the Rod, and two Washers space each from the Motor side plates. The Gears are loose on the Rod but are held in place by Collars, and each carries two Threaded Pins. The Pins engage Bush Wheels secured in the Socket Couplings 1 and 2, which are also free on the Rod, and carry the two members of a Dog Clutch.

The Socket Coupling 2 is slid to and fro by means of a selector on the Rod 3, bearings for which are formed by two 1½" Flat Girders. A Coupling is mounted on the Rod and carries in its end tranverse bores short Rods that engage either side of the groove in the Socket Coupling. The longer Rod is surmounted by the Collar 4, which holds in place a ½" loose Pulley spaced from the Coupling by Washers. Three Compression Springs are placed on the Rod 3 between the Coupling and the Flat Girder, and a Washer separates each Spring. On the other side of the Flat Girder a Collar is carried on the Rod, and limits the extent of its travel. A similar mechanism controls the Coupling 1, but the sliding Rod is placed ½" lower, and the Springs operate in the opposite direction.

A simple Bell Crank 6 is placed over a Threaded Pin fixed on the 3½" × ½" Double Angle Strip. Three Washers are placed below the Crank and a Collar holds it in place. One arm of the Crank fits between the ½" Pulleys below the Collars 4 and 5, and to the other arm an End Bearing is pivoted. A 2½" Axle Rod connects this part to a further End Bearing that is pivotally attached to a Coupling on the Rod 7. The Rod carries also a 1" Sprocket Wheel.

In the centre of the 7½" Girder at the rear of the model a Double Arm Crank is bolted, and this carries a vertical 5" Rod on the upper end of which a Coupling is fixed. A 1" Rod in this part supports a further Coupling at right-angles, and this also is fitted with a 1" Axle Rod on which a 1" diam. Sprocket Wheel is free to rotate, but is retained in position by a Collar.

The Coupling 8 is free to slide on the vertical Rod and a 2½" Strip is pivoted to it by means of a Bolt passed through its centre hole and inserted in the tapped bore of the Coupling. The shank is locked in the Coupling by a Nut, so preventing it touching the Rod. The pivoted Strip is connected at each end by 3" Strips to the switches of the two Motors. A 1½" Strip 9 is rigidly held to the sliding Coupling by a Threaded Pin and Eye Piece. The Threaded Pin carries two Washers to prevent it from fouling the Rod. One end of the Strip 9 is bolted to a length of Sprocket Chain passed round the Sprocket on the Rod 7.

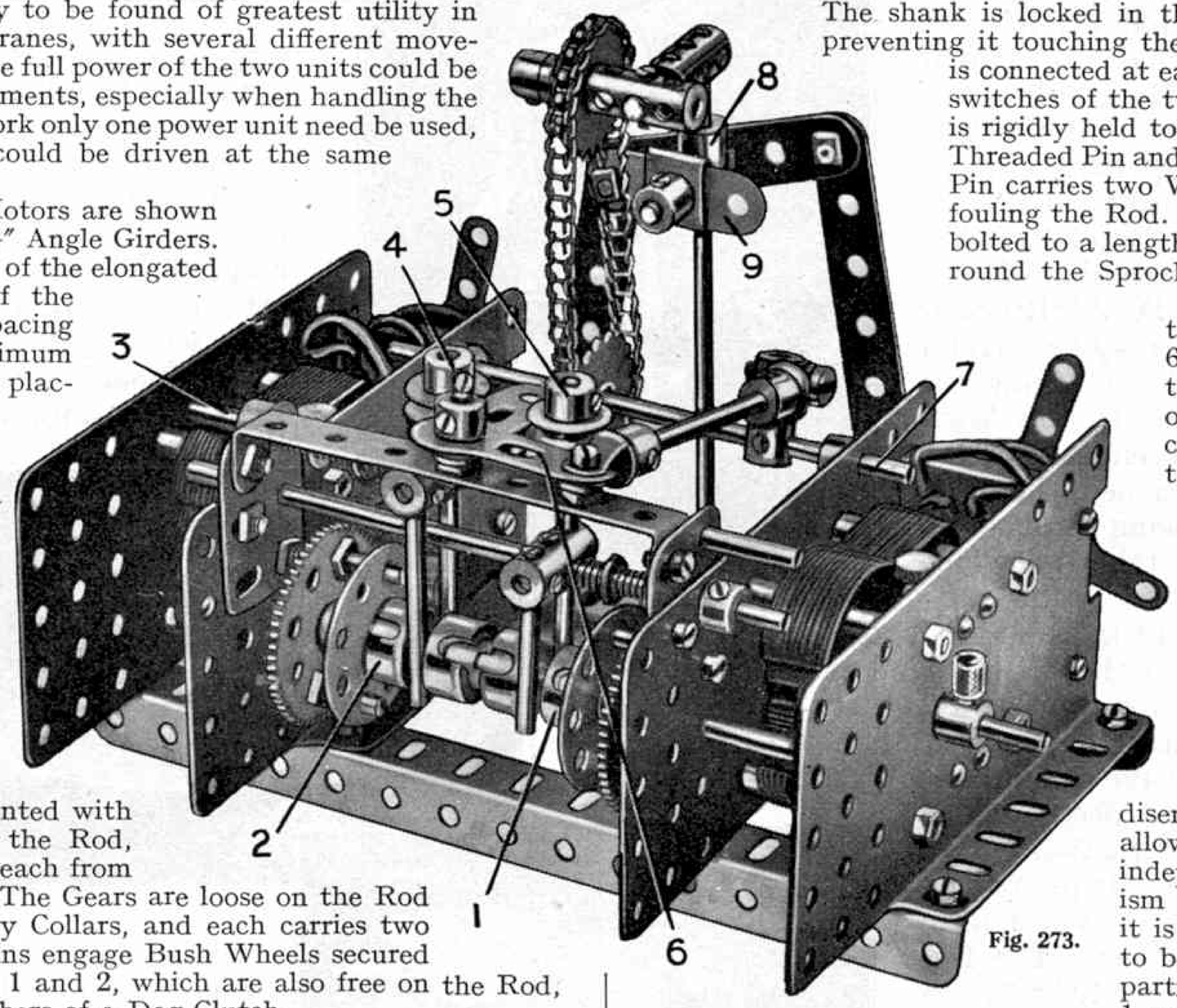


Fig. 273.

It will now be seen that with the Bell Crank 6 in the central position the Compression Springs on the sliding selector rods cause the Socket Couplings to move together until the Dog Clutch units engage. When the Crank is moved, however, it engages one of the ½" Pulleys and causes its respective selector to slide the Socket Coupling outward from the centre of the Rod against the action of the Compression Springs, so disengaging the Clutch. This allows the Motors to rotate independently. For the mechanism to operate satisfactorily it is essential for all the parts to be in proper alignment. In particular the Socket Couplings 1 and 2 should be free on their rods, and the Threaded Pins carried on the 57-teeth Gears should slide freely in the holes of the Bush Wheels. All sliding parts should be kept well lubricated. In Fig. 273 both Motor switches are in the same position and the Dog Clutch is engaged so that the two power units are coupled together. If both switches are moved simultaneously the Motors can be stopped or reversed and remain coupled, but if one switch only is operated the Coupling 8 is caused to slide up or down its Rod. The Strip 9 conveys this movement to the Sprocket Chain, which imparts a rotary motion to the Rod 7. A Coupling on this Rod operates the Bell Crank 6, which engages or disengages the Dogs in the manner described above.

To arrange the complete device for driving purposes the drive may be taken from the armature of either Motor. If several movements are to be driven, those requiring the full power of both Motors may be taken from one of the armature shafts, and the other shaft connected to the movements that require a lighter drive. For these operations the one power unit only may be used, and this will enable the model to be run with maximum economy. The gear-box in the model should be arranged in the same manner as if only one Motor is used, so that the various movements may be operated simultaneously or separately.

(274) Intermittent Motion (R. J. Grooms, Derby)

By means of this device it is possible to vary the period of dwell of the driven shaft to suit almost any requirements. The mechanism is extremely simple and compact and can be easily mounted in position on a model. In Fig. 274 it is shown bolted to the 6-volt Electric Motor, the drive from which is conveyed by a Worm to the 57-teeth Gear on a 5″ Rod journalled in Flanged Trunnions. The Trunnions are spaced from the Plate by Washers to allow clearance for the 57-teeth Gear.

A 1⅛″ diameter Flanged Wheel 1 is fixed on the Rod and at the outer end of the Rod is a Bush Wheel. A Socket Coupling is fitted with a ½″ Pinion and a Bush Wheel, which should be carefully trued up so that the unit rotates freely on the Rod. A 1″ loose Pulley carrying the Rubber Ring 2 is placed between the Bush Wheel and the Flanged Wheel 1, and a Compression Spring at the other end of the sliding unit normally holds the Wheels in close contact with the Ring so that the drive is transmitted through the ½″ Pinion to the ¾″ Contrate Wheel 3.

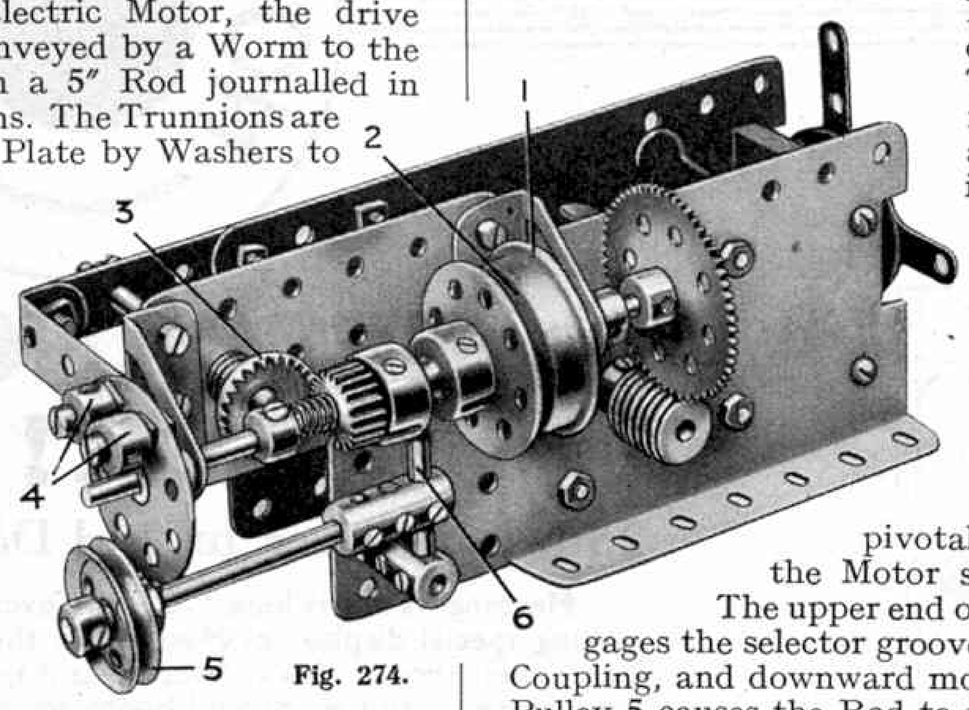


Fig. 274.

The Bush Wheel on the end of the 5″ Rod carries two Collars 4 that are free to rotate on ½″ Bolts. As the Bush Wheel rotates the Collars force the 1″ loose Pulley 5 downwards. The Pulley is free to turn on a 2½″ Rod that is held in a Coupling fitted on a 1½″ Rod 6, which is also carried in a Coupling by means of which it is pivotally attached to the Motor side plate.

The upper end of the Rod 6 engages the selector groove of the Socket Coupling, and downward movement of the Pulley 5 causes the Rod to force the Bush Wheel out of engagement with the Rubber Ring 2, thus bringing the driven shaft to a standstill until the clutch is re-engaged. The Compression Spring brings the clutch together again as soon as the Collars 4 release the Pulley 5. By increasing the number of Collars the period cf dwell can be increased at will.

(275) A Unique Drive

(Gian Singh, Imritsar, India)

Occasions sometimes arise when it is required to transmit a drive through two shafts that are mounted end to end but not in a direct line. If space permits, Universal Couplings can generally be used to connect the two shafts, but if the inner ends of the Rods are close together this method cannot be employed owing to lack of space, and also because the Couplings are unsuitable for driving through a very great angle.

An ingenious idea for connecting shafts that are placed out of line is shown in Fig. 275. This is suitable for use in almost every case where lack of space prevents Universal Couplings or Spring Coupling Units from being employed. The driving shaft 1 is approximately ½″ out of line with the Rod 2, and each Rod carries at its inner end a Face Plate. Four Flat Brackets are pivotally attached to the Plates, as shown, by means of ⅜″ Bolts, each of which carries two Nuts for holding the Brackets in place. Washers are used for spacing purposes, and when in position the Bolts should be sufficiently loose to allow the Flat Brackets to move freely.

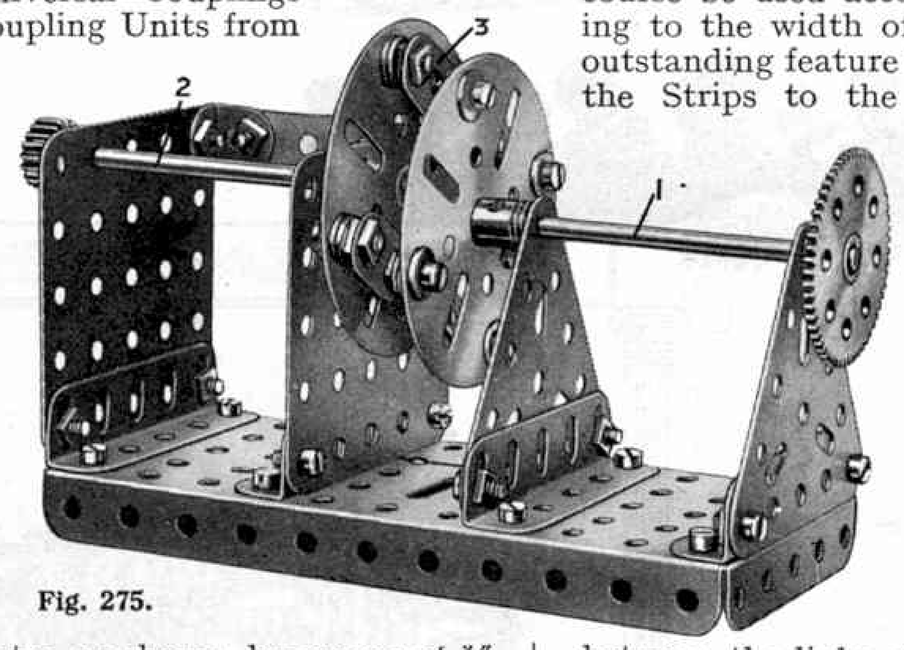


Fig. 275.

As the Rod 1 rotates, the movement of the one Face Plate is imparted to the other by means of the Flat Brackets.

(276) Creeper Track

(F. S. Simpson, London, N.19)

The method of constructing creeper track shown in Fig. 276 has the advantage over other forms of track in that it requires fewer parts to construct. It will be found very suitable for models of lorries intended for use over rough ground and for military tanks, etc. The track consists of a number of 2½″ Strips attached to two lengths of Sprocket Chain. Shorter or longer Strips may of course be used according to the width of track required. The outstanding feature is the method of fixing the Strips to the Chain, and for this purpose paper fasteners of the split-pin type are used. They are passed through the Strips and inserted between the links of the Chain, after which the shanks are bent outward to prevent the clips from slipping out. The parts should be so bent to allow space for the teeth of the Sprockets to pass between the links of the Chain.

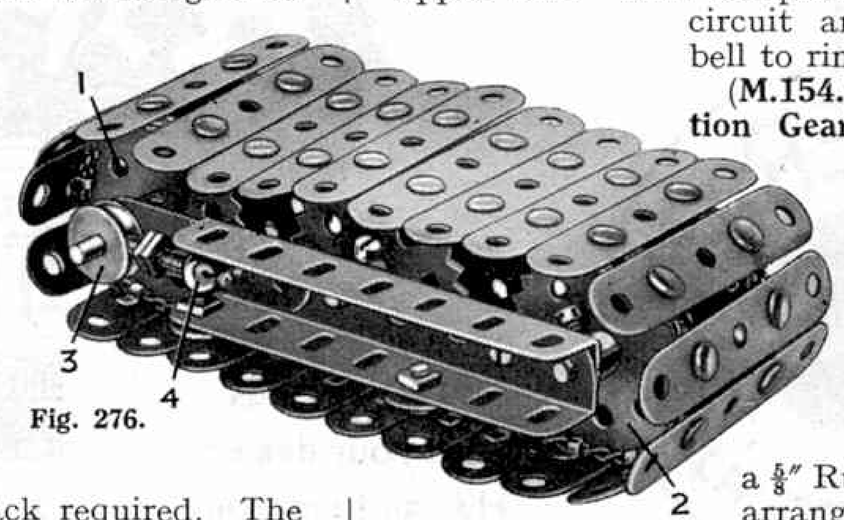


Fig. 276.

Two 3½″ Angle Girders, secured together to form a channel section girder, form each side member in which the Rods carrying the Sprockets are journalled. The Girders are extended by 2″ Slotted Strips, and the Rod of the Sprocket 1 is journalled in the elongated holes of these. A Handrail Support 4 at each side carries in its tapped bore a short Screwed Rod that engages the Pulley 3.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(**M.152.**) **Sandpapering Device.** A sandpapering machine for finishing off small woodworking jobs has been devised by Brian Denny (London, N.2). The device consists essentially of a belt of sandpaper passed round two Wood Rollers driven from an Electric Motor. The Rollers are mounted in a suitable frame, and the Rod of one is journalled in the elongated holes of 2″ slotted Strips. A suitable tightening device (such as that shown in Fig. 276) is arranged to prevent the sandpaper from sagging too much.

The work to be sandpapered may be applied to the belt, or if too large for this, the rotating belt can be moved to and fro over the wood. In this case there should be no projections such as bolt heads, etc., to prevent the belt from touching the wood.

(**M.153.**) **Alarm Device for Cranes.** To prevent over-winding of a load in model cranes, D. Walsh (Warrington) has evolved a simple device that can be applied to any model. The hoisting cord, after passing over the jib-head Pulley, goes through the longitudinal bores of two Couplings. The upper Coupling is suspended about 6″ from the jib head by means of a length of flexible insulated wire, and a length of similar wire holds the lower Coupling, which normally hangs slightly below the first. These two wires are connected in series with the battery and an alarm bell, so that when the lower Coupling is lifted by the load hook it makes contact with the upper one. This completes the electric circuit and causes the bell to ring.

(**M.154.**) **Internal Friction Gearing.** A novel form of gearing employed by J. Bennett (Bristol), consists of a 1″ Pulley fitted with a ⅝″ Rubber Ring and arranged to engage the inner surface of the rim of a Wheel Flange. This provides a gear ratio of approximately 1 2/3 : 1, and the great advantage of the device is that both driving and driven shafts rotate in the same direction. A slightly smaller ratio can be obtained by using a Dunlop Tyre instead of a Rubber Ring. This form of gearing would simplify the construction of an epicyclic gear-box, and for this purpose a Hub Disc could be used in place of the Wheel Flange.

(**M.155.**) **Radiator Construction.** A new use for Sprocket Chain is for the construction of model motor car radiators. A framework is built up in the usual way by means of Strips and Angle Girders, Curved Strips being used where necessary. The top and bottom Strips at the front of the frame so formed are duplicated, the second Strips being bolted behind, and used for clamping in position short lengths of Chain. These are placed close together and give a most realistic finish to the radiator, being a very good representation of the "honeycomb" through which the water passes to be cooled in the radiator of an actual car.

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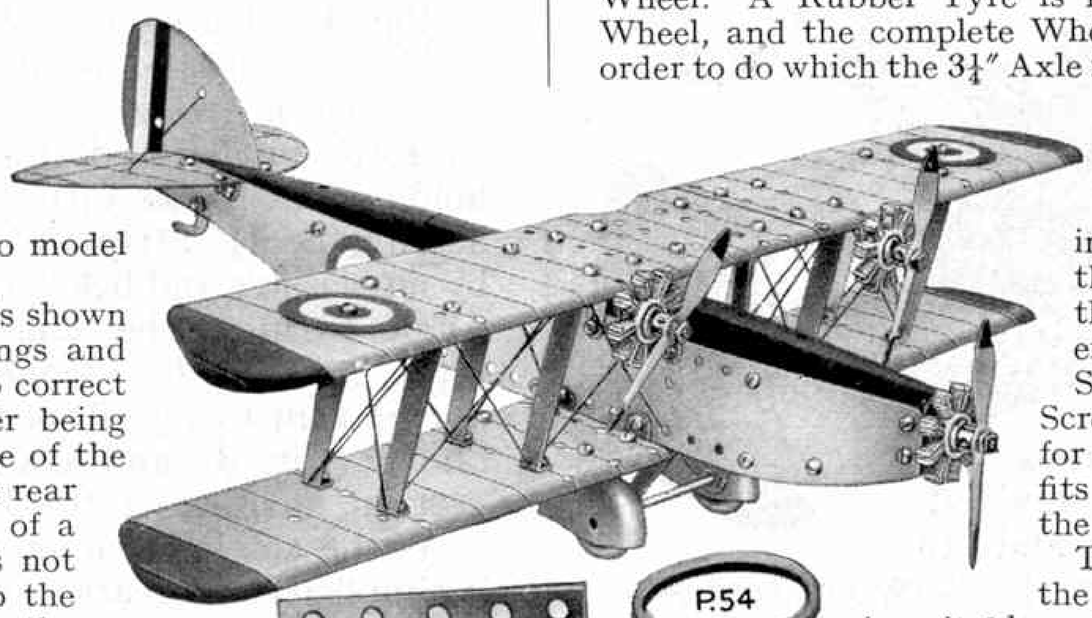
Meccano Aeroplane Developments

Greater Realism with New and Improved Parts

ALL keen model builders are anxious to construct models that are in line with the latest developments in actual practice, and readers therefore will be interested in the additions and improvements that have been made to the Meccano Aeroplane Constructor Outfits. Several new parts have been added to the range, and many of the original parts have been modified in order to produce models with an even more realistic and attractive appearance. The illustrations on this page of a three-engined air liner and a sea-plane constructed with the new Aero Parts give an excellent idea of the realism of the latest Meccano model aircraft.



A prominent feature of the models shown is the solid appearance of the Wings and Tail Planes. These are cambered to correct aerofoil section, the rise or camber being greatest at the front or leading edge of the Wing, and tapering gradually to the rear or trailing edge. The introduction of a cambered effect in the model does not affect the assembly of the wings to the Fuselage, or the attachment of the Interplane Struts, but the Angle Bracket, Part No. 12, cannot now be used to secure the Radial Engine units to the wings. A special Engine Bracket, P61, designed to fit to the cambered portion, must therefore be employed.

The inner edges of the Fuselage Top Front and Rear Sections are now shaped to represent the sides of the cockpit of the machine, and the windscreen in the front of the cockpit is represented by a raised lip on the Fuselage Top Front Section. The Fuselage Top Middle Section, which is used when a long fuselage model is being built, has also been modified so that it can be used with the Front and Rear Sections to form a continuous fuselage top portion.

The Fuselage Top Rear Section is now provided with a slot to take the projecting lug formed on the latest pattern of Rudder. The slot cut in the Fuselage Top Front is used when a Meccano Aero Motor is included in the model, the Motor Stop Control being fitted in the slot. The Fuselage Top Front and Rear Sections and the Underside are now enamelled red.

Turning now to the new parts, the Undercarriage Assembly, which consists of Parts P58 and P59, is particularly interesting. The new Undercarriage is seen fitted to the model triple-engined air liner shown on this page, and one of the Vee Struts and Wheel Shield units is also shown separately, Part P59.

Wheel Shields, or "spats" as they are commonly known, represent one of the latest developments in aeroplane design, and the spats that are fitted to the Meccano Undercarriage sections follow the design of the actual units.

The new Meccano Landing Wheel, Part P53, is of correct aero-section, the boss being placed in the centre with one wheel disc on each side. The Rubber Tyre, Part P44, of the large section low-pressure type, fits into the well base formed between the two discs of the wheel, and a remarkably neat assembly results. Owing to the fact that the boss of the Landing Wheel is hidden by the Rubber Tyre, a special method of fitting must be used when fixing the Landing Wheels in the Wheel Shields of the new type Undercarriage unit. This assembly is carried out as follows.

The $3\frac{1}{4}$" Axle Rod, No. P62, is pushed through one Undercarriage Vee Strut and Wheel Shield, and a $\frac{1}{2}$" Fast Pulley forming part of the Propeller drive is placed on the Axle. A Rubber Tyre is now fitted to one Landing Wheel, and the complete Wheel is then placed in the Wheel Shield of the second Undercarriage Vee Strut. The end of the $3\frac{1}{4}$" Axle is then passed through the hole in the Undercarriage Vee Strut and through the centre hole in the Landing Wheel. A Rubber Tyre is next fitted to the second Landing Wheel, and the complete Wheel is placed in its Wheel Shield, in order to do which the $3\frac{1}{4}$" Axle is drawn slightly to one side and then pushed back so that one end of it passes into the centre hole of the Landing Wheel.

Each Landing Wheel is locked in position on the Axle by rolling the Rubber Tyre to one side with the fingers, so that the Grub Screw is exposed and can be rotated by the Screwdriver. The new type Aero Screwdriver, Part P63, should be used for this operation, as its tapered blade fits in easily between the discs of the Landing Wheels.

The foregoing method of assembling the Undercarriage and Landing Wheels is suitable only when the "cross-axle" type of Undercarriage is to be fitted to the machine. Certain machines, for example those built with the No. 2 Outfit, use the "split" type of Undercarriage, and in such models the assembly is as follows. A Pivot Bolt is first of all pushed through the hole in the Wing Stay, Part P31, and a Landing Wheel complete with Rubber Tyre is placed in position in the Wheel Shield of the Undercarriage. The Pivot Bolt is passed through the Wheel Shield and the Landing Wheel, and held in position by means of two Locknuts. In this case the Grub Screw of the Landing Wheel is not tightened on the Pivot Bolt shank, and therefore the Grub Screw should be withdrawn slightly before the Landing Wheel is placed in position. Thus the Wheel will be able to spin round freely on the Pivot Bolt.

The Tail Skid, Part P55, replaces the Flat Bracket that originally did duty for this unit.

The Float Tie Rod, Part P57, is designed to be used in the Float Undercarriage assembly of sea-plane models. It is perforated at each end, so that it may be connected between the Floats by means of the Bolts that secure the Floats to the Float Struts.

The special Rear Bracket for Propeller Shaft, Part P56, takes the place of the $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip that was originally used for the purpose. This alteration does not affect the assembly of the mechanism, but it improves the efficiency considerably.

The illustrations on this page show how the Engine Casing Unit has been improved. It now possesses a correct streamlined appearance. The Engine Casing Top, Part P40, originally was held to the Engine Casing Base, Part P41, by means of a $\frac{3}{4}$" Bolt. A special 1" length of Screwed Rod, Part P82, is now provided for this purpose. The Rod is passed through the top and base pieces, and is held in place by a Nut screwed at each end.

A Propeller is of course secured to the Engine Casing in order to complete the power unit, and this should be attached to the Engine Casing Base before the Screwed Rod is fixed in position, by means of a Pivot Bolt and two Nuts. The Nuts are locked against the front lug of the Engine Casing Base.

Meccano "X" Series Models

A New System of Model Construction

THE illustrations on this and the opposite page show examples of the models that can be built with the new Meccano "X" Series Outfits. These Outfits contain an entirely new series of parts that make possible the construction of an almost unlimited range of models. Model-building with these parts is so simple that even our youngest readers will be able to start building immediately. "X" Series parts are perforated with the Meccano system of equidistant holes, but each Strip is provided with three rows of holes, and the perforations are spaced apart $\frac{1}{4}$" between centres. The Strips are each $\frac{3}{4}$" wide and are available in the lengths shown in the panel on this page. The Wheel Discs are not provided with bosses, and Screwed Rods are used for Axles. To fix the Discs on the Rods two nuts are used, one being held tightly against each side of the Disc.

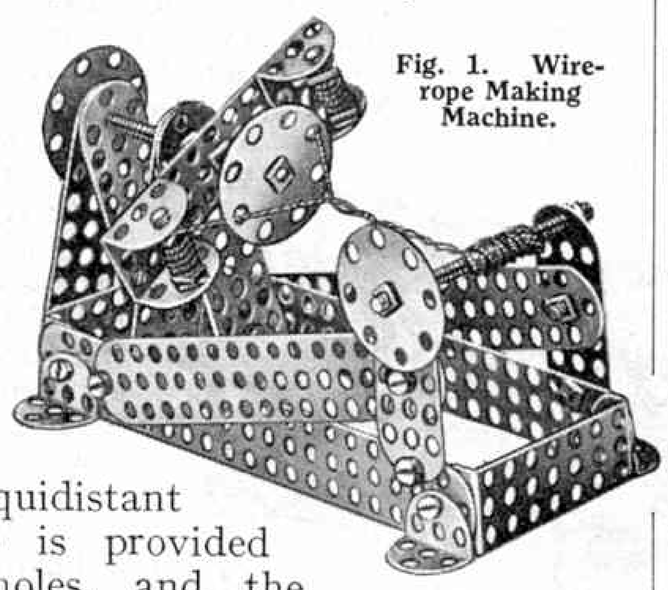


Fig. 1. Wire-rope Making Machine.

The Screwed Rods can be utilised for a number of purposes, and are useful as spacing members instead of Double Angle Strips. If Double Angle Strips are used in addition, they should be bolted in place first so that they are in the correct position before the nuts on the Screwed Rods are tightened up. The 1" Screwed Rods can be used for crank handles by fixing them to $1\frac{1}{4}$" Discs, and in No. 1 Outfit models a bolt shank may be used instead for the same purpose.

The method of making a pulley wheel is extremely simple. A large pulley can be made by placing two $\frac{3}{4}$" Discs close together on a Screwed Rod and mounting a large Disc on each side. Two nuts lock the four Discs together to form the complete pulley. A smaller pulley can be made from two $\frac{3}{4}$" Discs and a Washer; such a pulley is used at the jib head of the Steam Shovel (Fig. 3) and Derrick Crane (Fig. 9). In each case the Screwed Rod carrying the Discs holds the side members of the jib together and does not rotate. A little clearance is allowed between the $\frac{3}{4}$" Discs and the nuts securing the Strips, so that the pulley rotates freely on the Rod, but the clearance should not be excessive or the cord will slip off the Washer and drop between it and one of the side Discs.

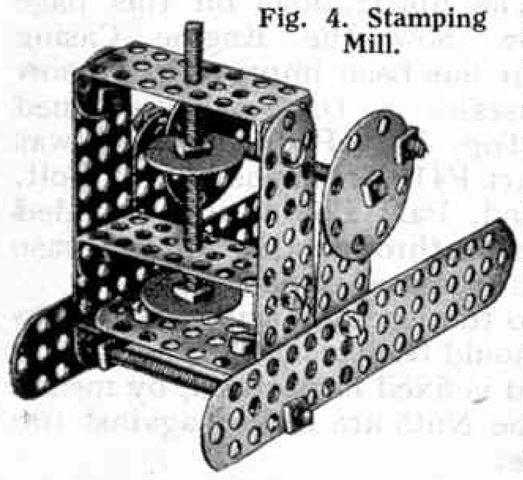


Fig. 4. Stamping Mill.

Pivoted joints are made by passing a bolt through one part and securing it to the other by two nuts. This will be made clear on reference to Fig. 5. The Double Angle Strip carrying the front pair of wheels is free to swing to steer the model, and the bolt holding this passes through the end hole in the $4\frac{1}{4}$" Strip and is secured by nuts above and below the Double Angle Strip. The same form of pivot is used for connecting the bucket arm to the jib of the Steam Shovel (Fig. 3), and also at the top and bottom of the vertical member of the Derrick Crane (Fig. 9).

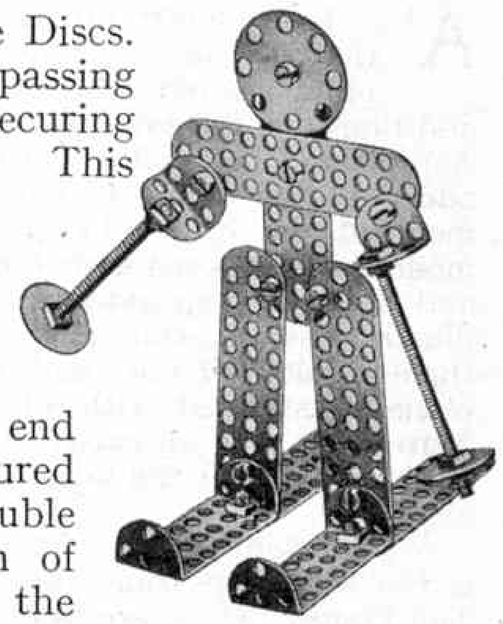


Fig. 2. Ski Runner.

As the chief characteristic of the "X" Series Models is simplicity, no gears are included in the range of parts. For transmitting the drive between two shafts, built-up pulleys should be used, with a rubber band for the belt. Rubber gives more satisfactory results than cord, as the knot in the latter does not ride easily over the pulleys. A right-angle drive may be obtained by means of friction gearing, and this form of drive transmission gives very good results in the small models.

In Fig. 8 a Roundabout model is shown incorporating a right-angle drive between the shaft of the hand-wheel and the vertical shaft carrying the arms from which the boats are suspended. The Screwed Rod to which the crank handle is fitted carries a $1\frac{1}{4}$" Disc, and a $\frac{3}{4}$" Disc on the lower end of the vertical Screwed Rod rests on this part. The weight of the revolving arms and flyboats keeps the $\frac{3}{4}$" Disc pressed closely to the edge of the large Disc, and as the latter is rotated it causes the small Disc to rotate also. By using a driving Disc larger than the driven Disc a "step-up" ratio is provided, that is, one in which the driven shaft rotates faster than the driving shaft. By interchanging the Discs a reduction ratio is obtained, in which the driven shaft rotates slower than the driving shaft.

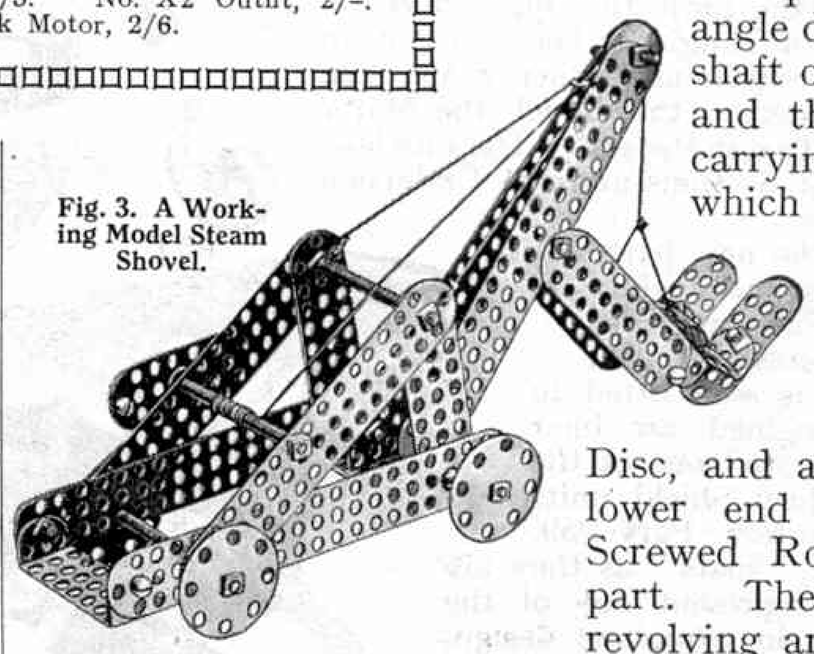


Fig. 3. A Working Model Steam Shovel.

An interesting mechanical movement is utilised for operating the model Stamping Mill (Fig. 4). The stamp consists of a $\frac{3}{4}$" Disc mounted on the lower end

Meccano "X" Series Parts

Part No.	X404	Perforated Strips, $5\frac{1}{2}$".
" "	X405	" " $4\frac{1}{4}$".
" "	X407	" " $2\frac{3}{4}$".
" "	X409	" " $1\frac{3}{4}$".
" "	X421	Angle Brackets.
" "	X435	Screwed Rods, $2\frac{1}{2}$".
" "	X438	" " 1".
" "	X455	Double Angle Strips, $1\frac{3}{4}$"×$\frac{1}{2}$".
" "	X457	" " $\frac{3}{4}$"×$\frac{1}{2}$".
" "	X475	Discs, $1\frac{1}{4}$".
" "	X477	" $\frac{3}{4}$".
" "	X491	Combined Spanner and Screwdriver.
" "	37a	Nuts.
" "	37b	Bolts, 7/32".
" "	38	Washers.
" "	57c	Hooks (loaded).

Prices: No. X1 Outfit 1/3. No. X2 Outfit, 2/-.
X Clockwork Motor, 2/6.

of a Screwed Rod that is free to slide up and down in its bearings. A $1\frac{1}{4}$" Disc on the driving Rod is provided with a bolt, the shank of which is arranged to strike the underside of a second $\frac{3}{4}$" Disc on the sliding Rod. As the large Disc rotates it raises this Rod until the bolt releases the small Disc and allows the stamp to drop. When the hand-wheel is rotated the bolt strikes the small Disc a rapid succession of blows, so that the stamp moves quickly up and down.

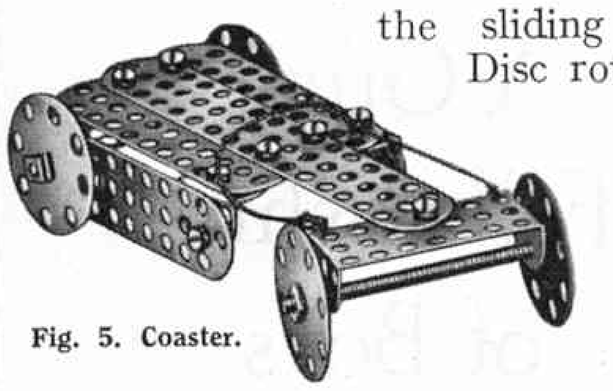
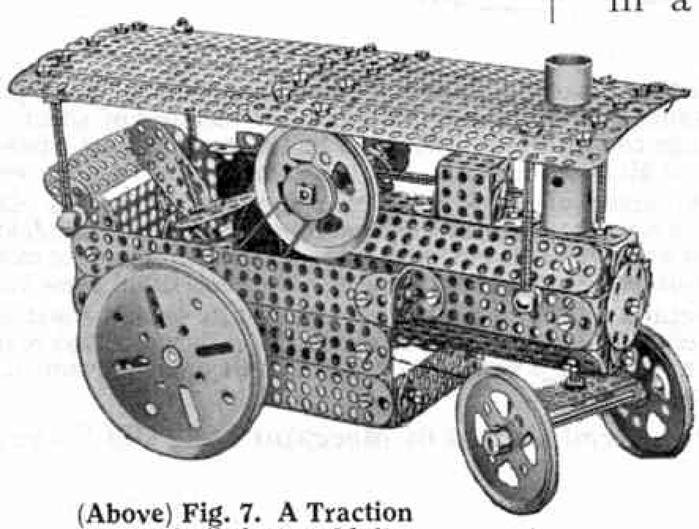


Fig. 5. Coaster.

Although only two different "X" Series Outfits are available, there is no limit to the size of the models that can be built. Splendid models of a great variety of types can be produced by combining the contents of several Outfits. The Traction Engine model (Fig. 7) is an example of what can be done in this way, and it also shows how effectively standard Meccano parts can be incorporated in "X" Series models. For this traction engine four No. 2 "X" Outfits are used, in addition to various standard Meccano parts, and the combination produces an extremely realistic appearance. For the road wheels 3" and 2" Pulleys are used, and a further 2" Pulley forms the flywheel. A $1\frac{1}{2}$" and a 1" Pulley are carried on the rear axle inside the side frames, and the drive from the small Pulley on the driving spindle of the Clockwork Motor is conveyed by a rubber band to the $1\frac{1}{2}$" Pulley on the axle. The 1" Pulley on this Rod is connected to a built-up pulley on the Screwed Rod carrying the flywheel. A neat chimney is formed from Meccano Sleeve Pieces and Chimney Adaptors.



(Above) Fig. 7. A Traction Engine built by combining the contents of several Outfits. Note the uses of standard Meccano parts. (Right) Fig. 8. A No. 2 Outfit model Roundabout.

Standard Meccano parts will be found very useful in the making of many of the larger "X" Series models, and model-builders will find also that "X" Series parts can be applied usefully in many ways in standard Meccano models.

A Clockwork Motor has been designed specially for driving the small "X" models, and its use in a No. 1 "X" Outfit model is illustrated in Fig. 10. A Pulley Wheel and a rubber driving band are supplied with the Motor, the Pulley having a threaded bore so that it can be screwed on the Rod and locked in place by one nut. The rubber band is passed round this Pulley and a second Pulley fixed on the Motor driving shaft. The Motor is so designed that it can be made to form part of the model into which it is built, and this effects a considerable saving in parts.

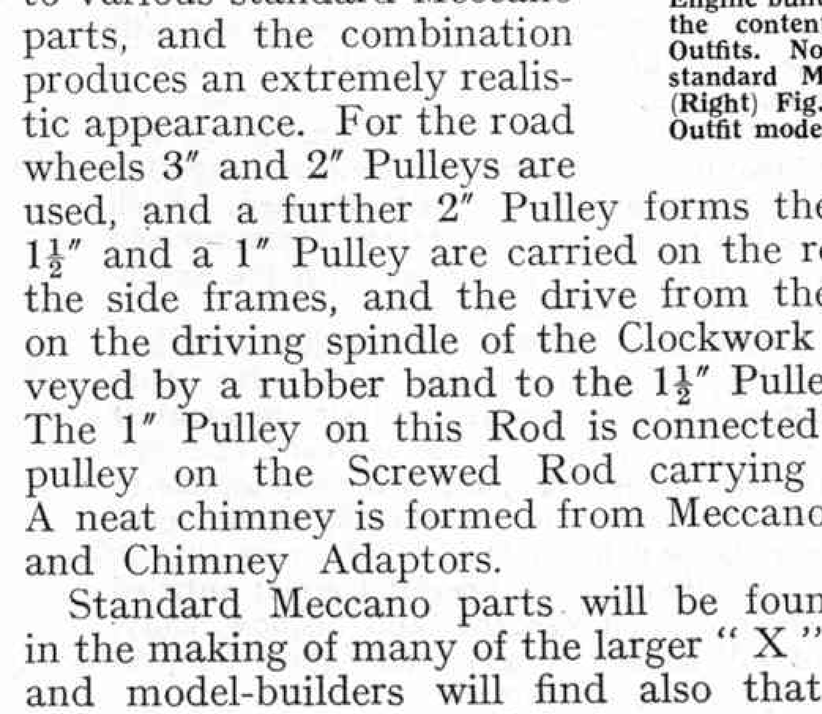


Fig. 9. Swivelling Derrick Crane.

An interesting working model is shown in Fig. 1. This represents a type of machine used for making multiple strand wire rope from the single strands of wire. In the model two bobbins are formed from 1" Screwed Rods with two nuts locked together at each end, and placed in position between $\frac{3}{4}$"$\times\frac{1}{2}$" Double Angle Strips. Fine wire or cord is wound on these Rods, and passes through holes in a $1\frac{1}{4}$" Disc on the same Rod that carries the $2\frac{3}{4}$" Strip to which the bobbins are attached. The two cords are tied to a Rod at the other end of the model, and as they are twisted together this Rod is slowly rotated so that the finished "rope" is wound in, and more cord is paid off the bobbins.

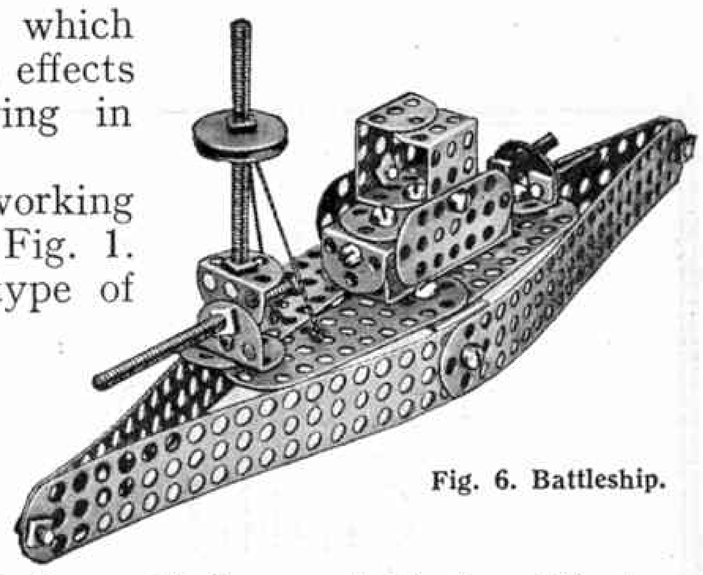


Fig. 6. Battleship.

The Mechanical Excavator (Fig. 3) is operated by a $1\frac{3}{4}$" Strip forming the crank handle, and attached to a Screwed Rod to which a length of cord is tied. The cord passes over the Pulley at the jib head and is tied to the digger bucket that can be raised or lowered by turning the handle. The nuts at the end of the winding shaft should be placed tightly against the Strips to prevent the cord from coming unwound when not required.

Many types of ship models can be built with "X" Series parts. A realistic Battleship is shown in Fig. 6. The construction of this is quite clear and requires little description. The after pair of guns consist of 1" Screwed Rods mounted on an Angle Bracket that is made to swivel by a bolt and two nuts.

The Derrick Crane (Fig. 9) is intended to be screwed down to a baseboard, and for this purpose Angle Brackets are placed at the foot of the sheerlegs. The object of this is to prevent the crane from overbalancing when handling a load. The vertical member is pivoted at the top and the bottom in the manner already explained. A $2\frac{1}{2}$" Screwed Rod is journalled between the vertical Strips and carries a Disc to which a bolt is fixed for a handle. Free rotation of the Screwed Rod is prevented by placing lock nuts close against the Strips, so that although the Rod can be rotated by hand, the load on the hook is insufficient to cause the cord to be paid out. The jib is retained at a fixed angle by two lengths of cord attached to the vertical member of the crane. The sheerlegs are each made by extending a $5\frac{1}{4}$" Strip with a $2\frac{3}{4}$" Strip to which a shorter Strip is bolted at an angle. These are held together by two Angle Brackets which carry the pivot for the swivelling post.

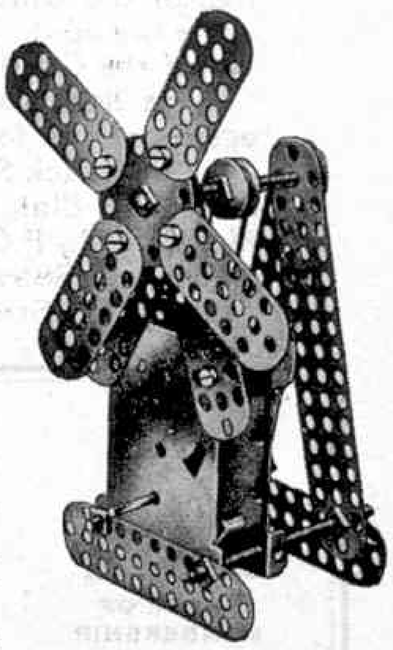
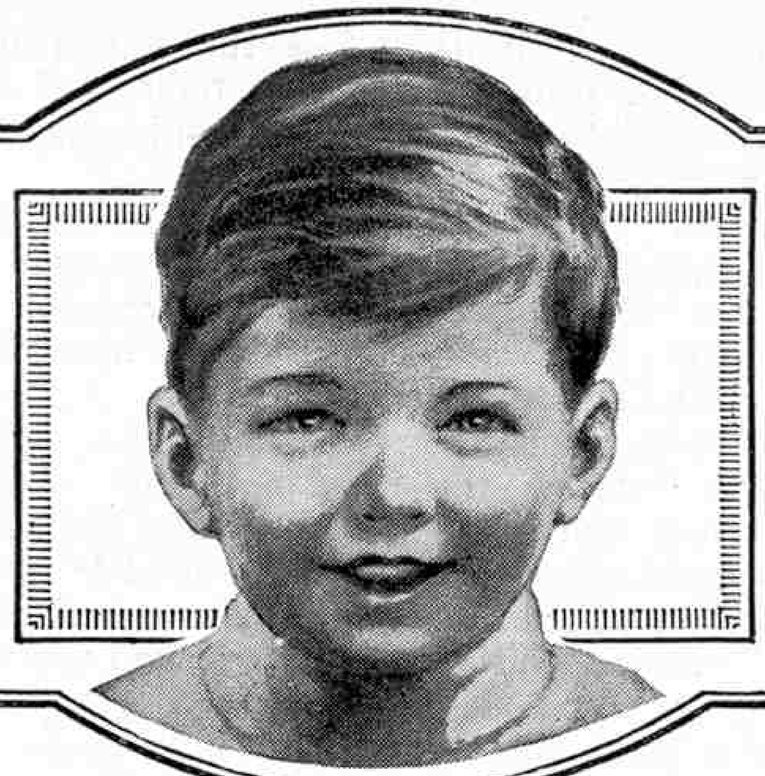


Fig. 10. Windmill with Clockwork Motor.

The Meccano Guild



A Great Fellowship of Boys

President: Mr. Frank Hornby ——Inventor of Meccano

What the Guild Means — The Meccano Guild is an organisation for boys, started at the request of boys, and conducted as far as possible by boys. In joining the Guild a Meccano boy becomes a member of a great brotherhood of world-wide extent, every member of which has promised to observe its three great objects; wherever he happens to be—even in strange countries—he will know he has met a friend whenever he sees the little triangular badge. The Meccano Guild is bringing together Meccano boys all over the world, and is helping them to get the very best out of life.

How it Commenced — More than a million boys derive their greatest indoor pleasure from Meccano. Before the Guild was formed, hundreds of these Meccano boys wrote to us every week. They told us how they wished they could be put into communication with other Meccano boys and how they longed to be able to meet them. They asked if arrangements could be made so that their wishes might become an accomplished fact. We responded to their repeated and increasingly numerous appeals, and as a result the Meccano Guild came into being.

Why You Should Join — Every Meccano boy should be a member of the Meccano Guild. All who have studied its objects must agree that the Guild cannot fail to have a profound effect for good on the lives of its members. It is ready to be of service to each individual member—to help or give advice whenever requested. At the head—guiding and controlling, and taking a personal interest in this great movement—is the President, Mr. Frank Hornby, Inventor of Meccano and Managing Director of Meccano Limited.

The Headquarters of the Meccano Guild are at the Head Offices of Meccano Ltd., Old Swan, Liverpool, England.

THE GUILD BADGE

Membership of the Guild is open to every boy possessing a Meccano Outfit or Hornby Train Set who satisfactorily fills in the application form. The only conditions are that members shall promise to observe the objects of the Guild and to wear their badges on all possible occasions.

The Meccano Guild badge is beautifully enamelled in blue and white. The ordinary form is made for wearing in the lapel of the coat, but brooch badges are issued to members who prefer to pin them in position, and applicants who wish to have this form of badge should indicate this when sending in their forms. In addition to the badge, each member receives a handsome Membership Certificate printed in orange and black. This is illustrated in the centre of the page.

HOW TO BECOME A MEMBER

In order to join the Guild all that is necessary is to fill up the form of application, and to forward it to the Secretary of the Meccano Guild, Binns Road, Old Swan, Liverpool, from whom an application form may be obtained if desired. A remittance to pay for the membership badge should be sent along with the completed form of application. The price of the badge is 7d. post free in the United Kingdom and 1/– post free Overseas (25 cents Canada). The applicant is then duly enrolled as a member of the Guild and his badge of membership is sent to him.

Boys living overseas should write to one of the Meccano agents at the following addresses: CANADA: Meccano Ltd., 34, St. Patrick St., Toronto. AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W. NEW ZEALAND: Models Ltd., P.O. Box 129, Paykel's Building, Anzac Avenue, Auckland. SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.

MECCANO CLUBS

Meccano Clubs are founded and established by enthusiastic Meccano boys under the guidance of the Guild Secretary at Headquarters. At the present time there are over 400 affiliated clubs in various towns and villages in this country and overseas, together with many others not yet affiliated. Each club has its Leader, Secretary, Treasurer and other Officials, all of whom, with the exception of the Leader, are boys.

Every Guild member should join a club if possible, for only in association with other Meccano boys is he able to obtain the greatest fun from his hobby. If the nearest club is too far away for him to join, or if he is unable to join it for any other reason, he should consider the possibility of forming a new club in his own district. A special booklet entitled "How to run a Meccano Club" is now ready, and will be sent to any reader (post free) on receipt of 2d. in stamps.

When a Meccano Club has been successfully launched and good progress is being made, affiliation with the Guild is granted. A beautiful club certificate, suitable for framing and hanging in the club-room, is presented, and the club becomes entitled to such privileges as the loan of interesting lectures and large models built at Headquarters.

THE CORRESPONDENCE CLUB

Members of the Guild are eligible to join the Correspondence Club, by which they are placed in communication with other Guild members in some other part of the country or abroad. To those boys who are interested in foreign languages the Correspondence Club presents a splendid opportunity of obtaining a correspondent in the particular country in the language of which they are interested.

THE THREE GREAT OBJECTS OF THE GUILD

(1) **To make every boy's life brighter and happier.**
(2) **To foster clean-mindedness, truthfulness, ambition, and initiative in boys.**
(3) **To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.**

BADGE OF MEMBERSHIP

CLUB LEADER'S BADGE

OBJECTS of the GUILD

To make every boy's life brighter and happier.

To foster clean-mindedness, truthfulness, ambition and initiative in boys.

To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

The Meccano Guild

Christmas Greetings

Once more I have the pleasure of wishing all members of the Guild and of Meccano Clubs throughout the world "A Merry Christmas." I also wish that I could visit every club during the festive season in order to convey my greetings personally, for the accounts that have reached me of the keenness displayed by members in making preparations for social meetings seems to indicate that this Christmas will be a memorable one in Meccano club circles. To visit more than 400 clubs, many of which are in countries as far away as Canada, India, South Africa, Australia and New Zealand is impossible, of course, and I must be content with hoping that every member will have a thoroughly enjoyable time.

To be able to send Christmas greetings round the world, and to know that they will be reciprocated by thousands of Meccano boys in practically every civilised country, is a privilege of which very few can boast. The Guild now numbers more than 90,000 members, but the great exchange of good wishes at this time of the year is impressive not only because of the enormous number of recipients, but also because it gives a proof that Meccano boys are in truth "Good Companions." The triangular badge is the symbol of their community of interests, wherever they may live, and they show their appreciation of the true meaning of comradeship in almost every activity, whether this is carried on in the club room or out of doors.

Good Companionship in Club Life

An interesting example of the good companionship in everyday activities that makes club life so enjoyable was brought to my notice recently by one secretary in his review of the progress of his club during the summer session. Swimming had played a great part in the programme of the outdoor season. I am firmly convinced that every boy should be a swimmer and should know something about life-saving methods, and therefore I was delighted to find that every member of this club is now able to swim. The secretary remarked that this was not the case a few months earlier, and on turning to his monthly reports I learned that members regularly visited the Baths as a club party, and those who were already experts helped and encouraged the others in their endeavours to make themselves at home in the water. Their assistance was given quietly, and without the feeling that it called for praise and reward. This made it the more effective, for both the action and the manner in which it was performed spoke only of genuine friendship and the desire to help. It is certain that some of those who became swimmers would not have persevered if they had not been backed up by their fellow-members, and in all probability some of them would never have even commenced to learn.

I could give many other examples of quiet help and assistance rendered in this manner, but the one I have quoted is sufficient to show the advantages of cultivating a really good club spirit.

Meccano Club Leaders

No. 62. Mr. H. Tunks

Mr. H. Tunks is Leader of the Fallowfield Baptist (Manchester) Life Boys M.C., the members of which belong to the Life Boys organisation, the junior branch of the Boys' Brigade movement. The club was affiliated in March this year and the first efforts of members were devoted to the building of a splendid series of models for display at the Life Boys' Models and Handicrafts Exhibition held at Weaste.

Special Merit Medallions

I should like to receive nominations for Special Merit Medallions as soon as possible in order to enable me to publish in an early issue of the "*M.M.*" my usual list of awards made during the past year. Prompt notification will serve another useful purpose. Many Leaders like to present Special Merit Medallions and other prizes at Exhibitions or social meetings held during the Christmas and New Year holiday season. Those who wish to do so should give me notice in good time, for the Medallions must be suitably engraved before being despatched from Headquarters.

I remind Leaders that two Merit Medallions are allotted every session to each club. They are presented to the members who, in the opinion of the Leader, have done the most valuable work on behalf of their club, and there are no restrictions in regard to the nature of the services for which awards may be made.

* * * *

The Plymouth M.C. are holding an Exhibition on Saturday, 3rd December, at the Tudor Hall, Milehouse. The Exhibition will be opened at 3 p.m. and the charge for admission is 3d., children 2d.

An extensive range of Meccano models will be on view at this Exhibition and visitors also will have a splendid opportunity of seeing the realistic operation of passenger and goods trains on the miniature railway layout of the Hornby Train section of the club. A very cordial welcome will be given to Meccano boys and to all interested.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places and boys interested in becoming members should communicate with the promoters, whose names and addresses are given below :—

AUSTRALIA—H. Howard, Brogo Via Bega, South Coast, N.S.W.
BLACKPOOL—Mrs. E. J. Oldham, 94, Collingwood Avenue, Layton.
BRISTOL—J. Smallcombe, "Channons," Oakwood Avenue, Henleaze.
CORSHAM—A. H. Stoodley, "Melrose," Pickwick Road, Corsham.
HOLLAND—G. Cuypers, Prof. Poelsstraat 32, Hilversum.
HORNCHURCH—Mr. F. G. Lacey, "St. Mary's," 95, North Street.
LEICESTER—Mr. H. Talbott, 93, Narborough Road.
LONDON—H. Baker, 12, Cleveland Mansions, Willesden Lane, Kilburn, N.W.6.
LONDON—Mr. R. C. Dyer, 273, Valley Road, Streatham, S.W.16.
MAURITIUS—M. Gaud, 4 Leoville L'homme Street, Port Louis.
NEW ZEALAND—R. Bertram, Church Lane, Nelson.
NEW ZEALAND—R. F. Carr, c/o New Zealand Railways, Rangataua, K.C.
NOTTINGHAM—Pastor Edward T. Hobbs, 97, Nottingham Road, New Basford.
SOUTH AFRICA—John Fowler, P.O. Box 24, Malmesbury.
WORKINGTON—J. Minto, 3, Armstrong Street.

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No. 1 Special Goods Set	32/6
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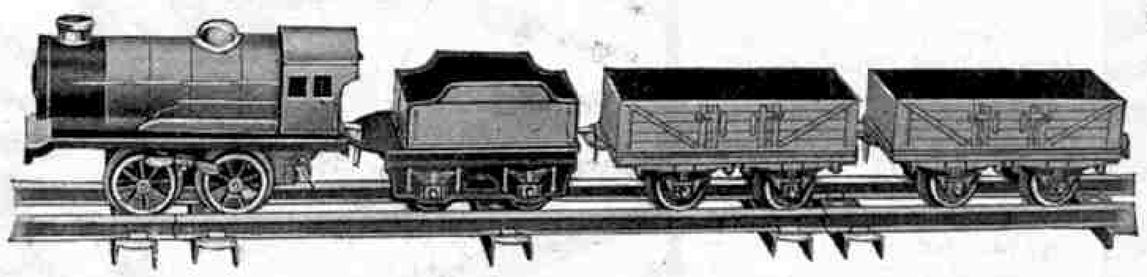

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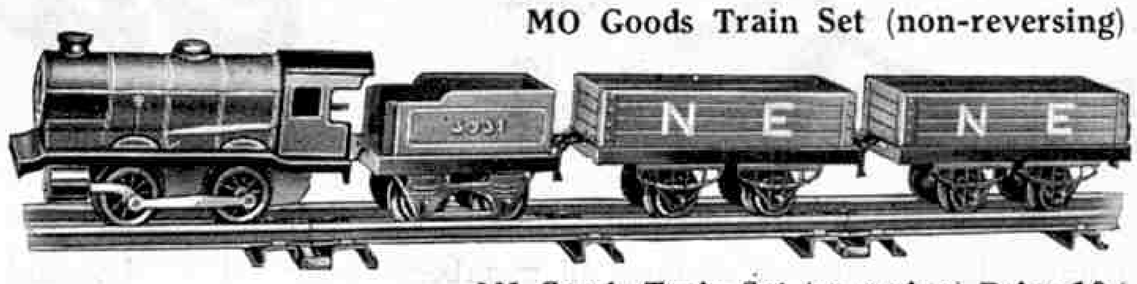

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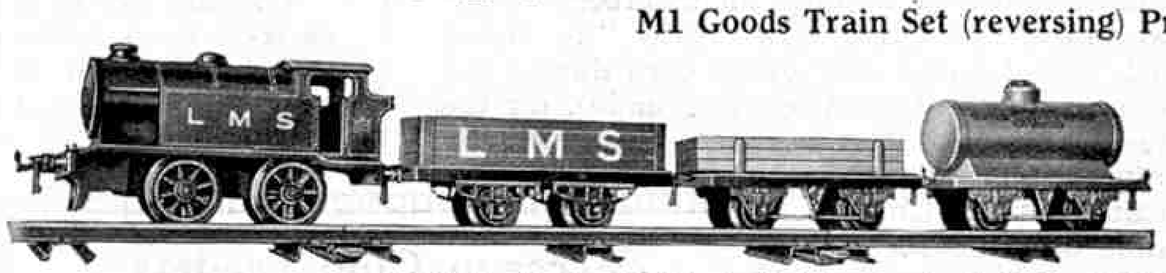

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Hornby No. O Goods Train Set (reversing) Price 18/6

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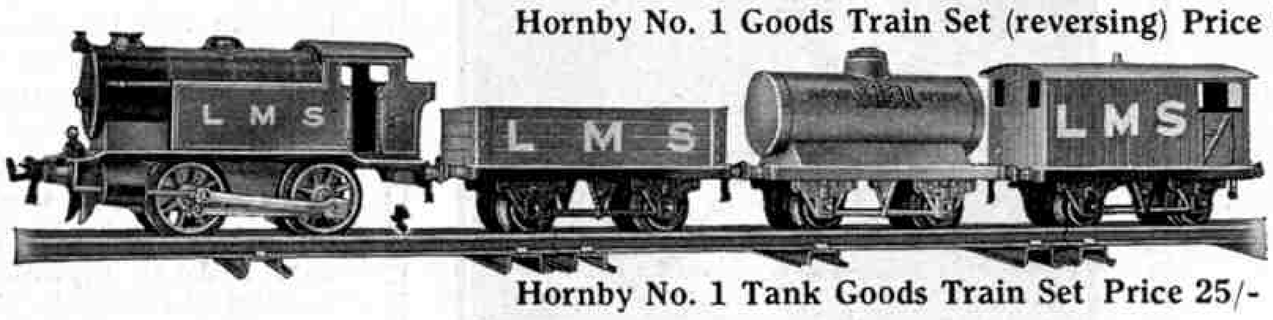

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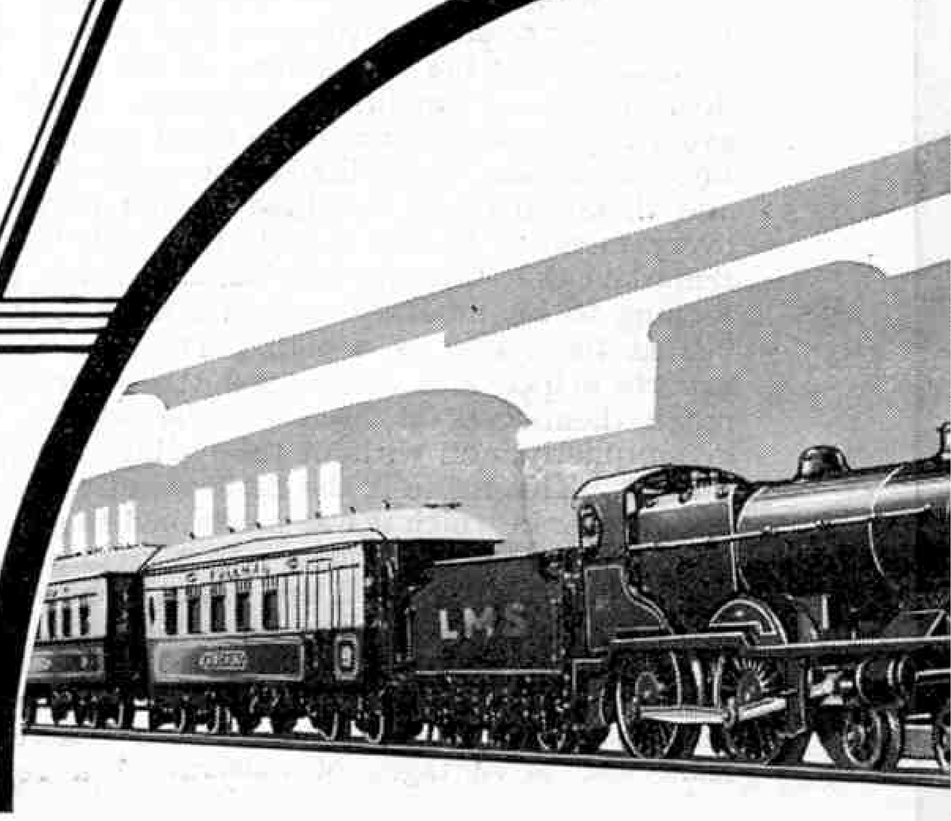

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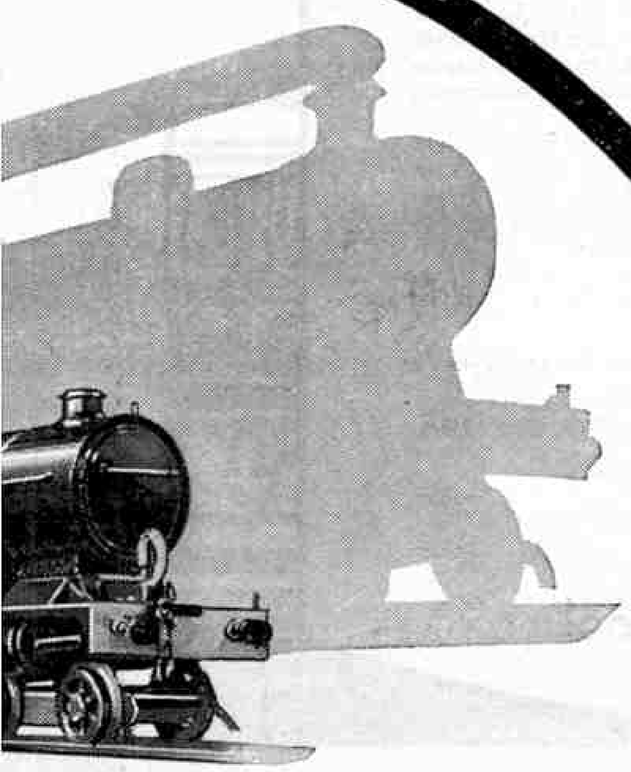
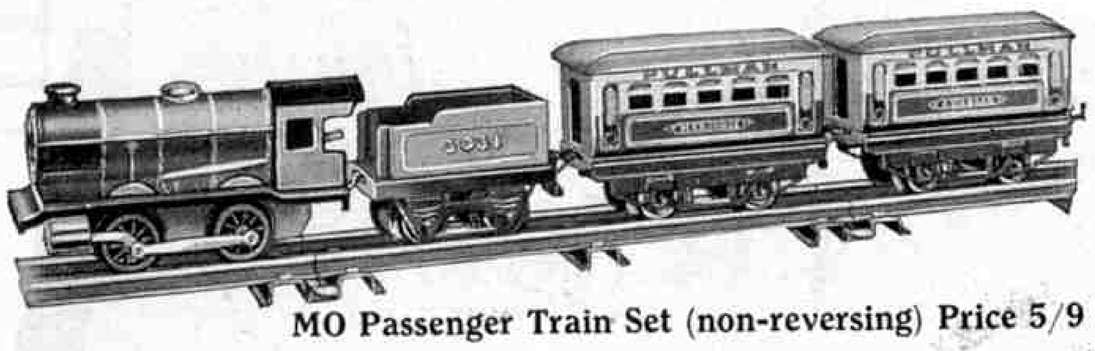
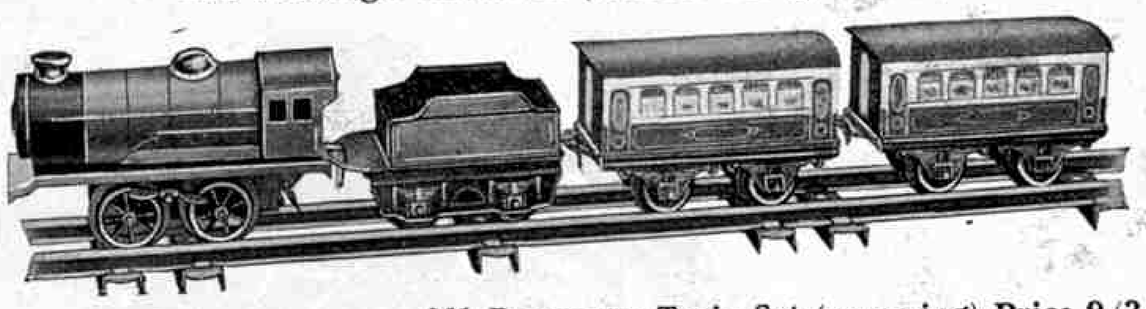
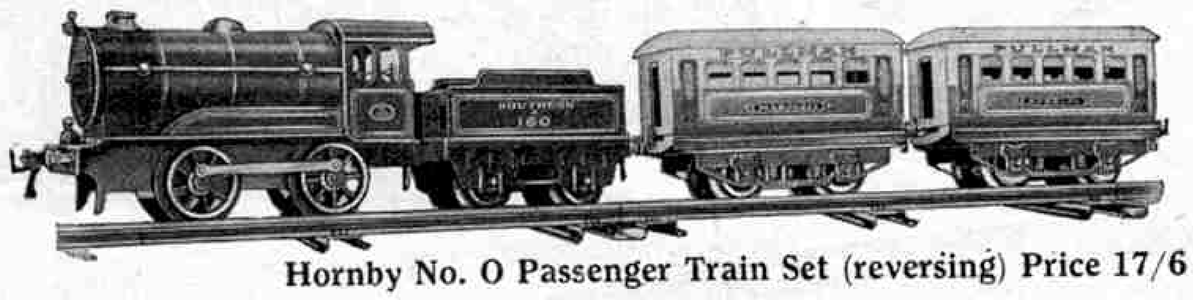




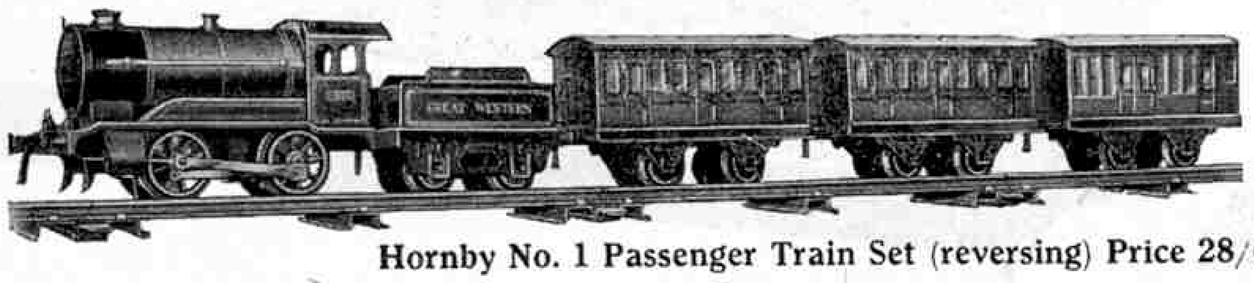
MO Passenger Train Set (non-reversing) Price 5/9



M1 Passenger Train Set (reversing) Price 9/3

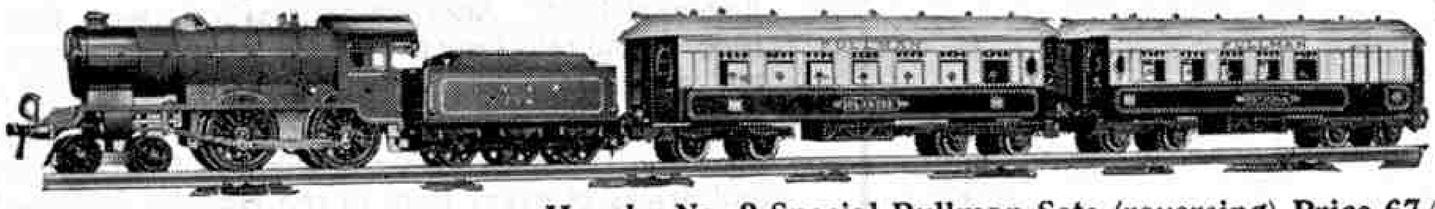


Hornby No. O Passenger Train Set (reversing) Price 17/6

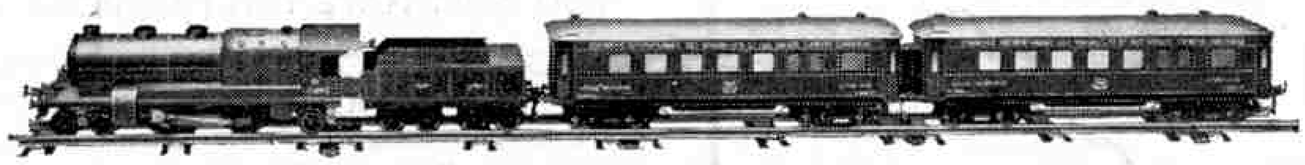


Hornby No. 1 Passenger Train Set (reversing) Price 28/6

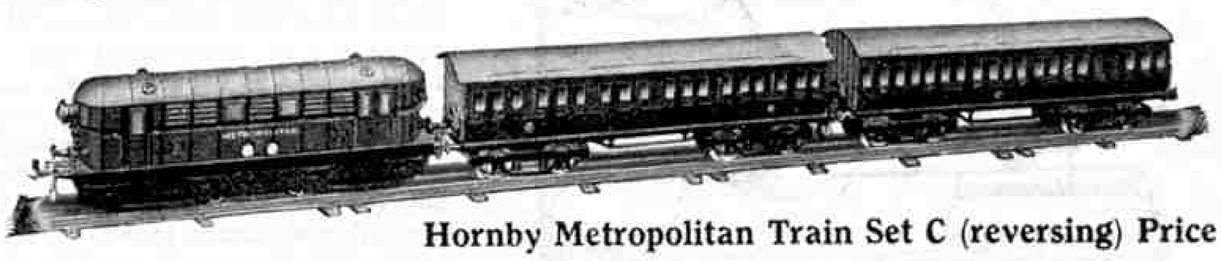
Hornby No. 1 Special Passenger Train Set (reversing) Price 35/–



Hornby No. 2 Special Pullman Sets (reversing) Price 67/6



Hornby No. 3C Riviera " Blue " Passenger Train Set (reversing) Price 62/6



Hornby Metropolitan Train Set C (reversing) Price 45/–

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No. 1 Passenger Set	28/6
No. 1S Passenger Set	35/–
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Metropolitan Set C	45/–

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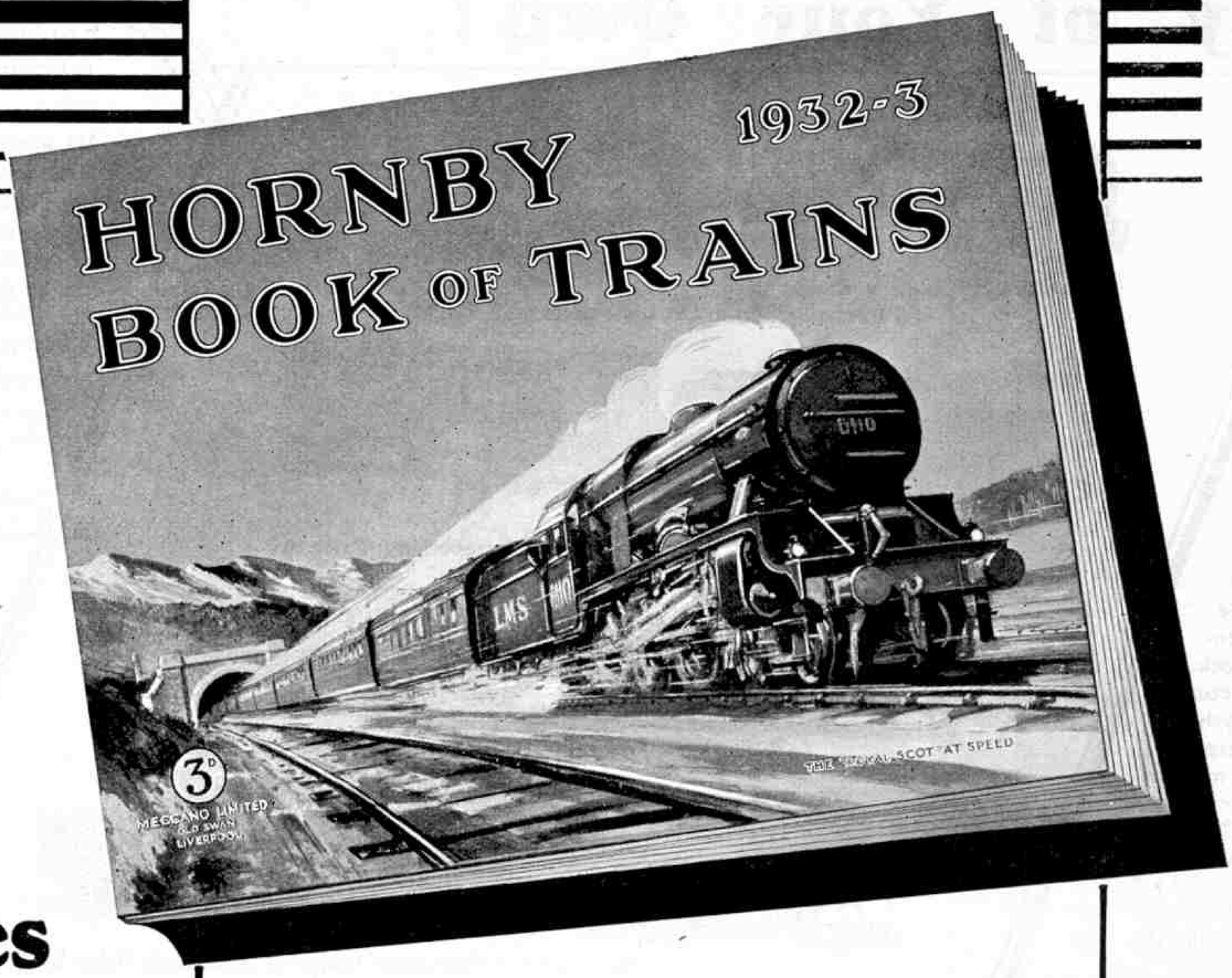

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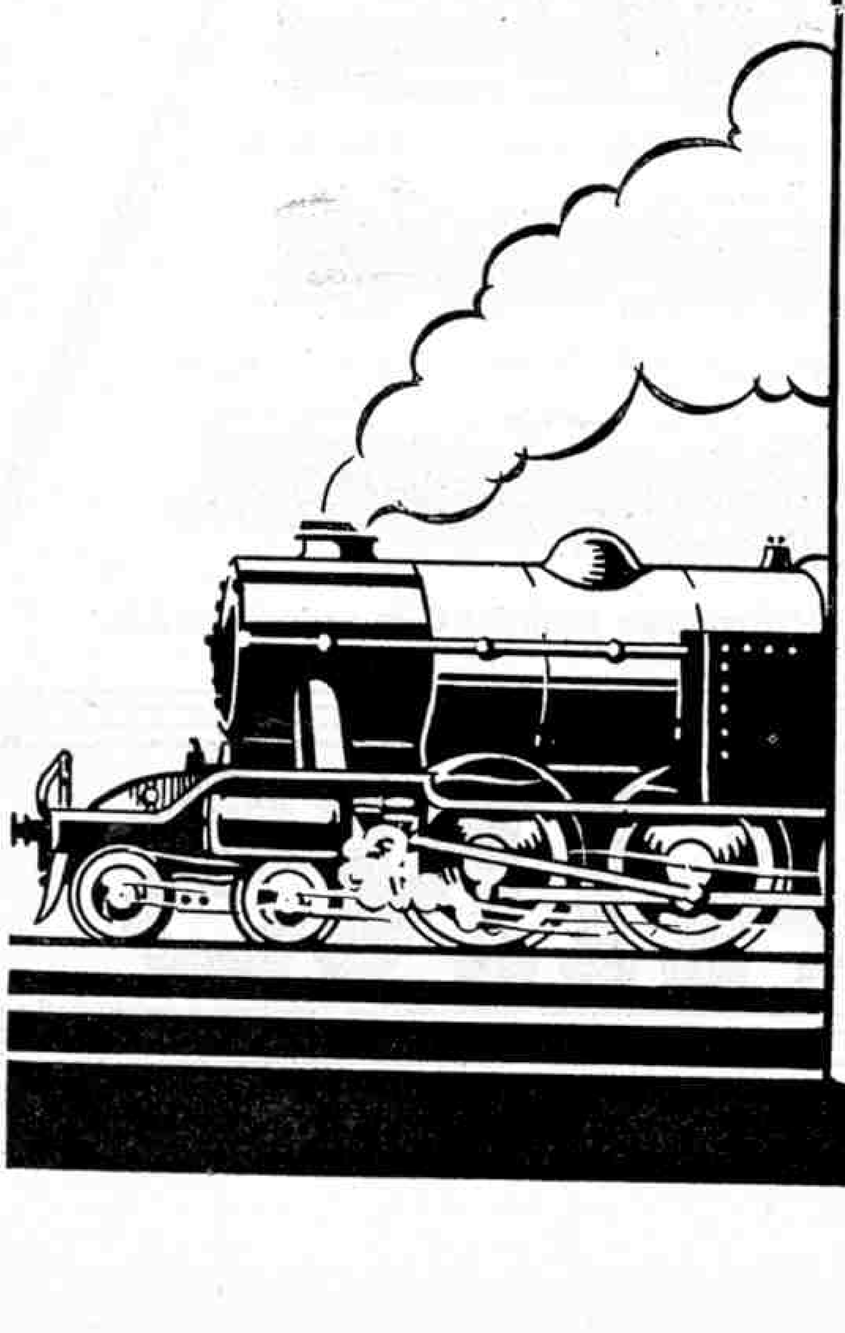

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HOW TO OBTAIN THE BOOK

The Hornby Book of Trains may be obtained from any Meccano dealer, price 3d., or direct from Meccano Ltd. (Dept. A.M.), Binns Road, Old Swan, Liverpool, price 4½d. post free. In the latter case a remittance in stamps should be sent and the name and address of the sender should be clearly written. There is no reduction if more than one copy is ordered.

Direct orders are not acknowledged. They are dealt with as soon as they are received, and every endeavour is made to send the book to the purchaser by return of post.

ORDERS FROM NEW ZEALAND, SOUTH AFRICA AND CANADA

Supplies of the Hornby Book of Trains have already been despatched to our agents in New Zealand, South Africa and Canada to fill orders received. The New Zealand and South African price is 6d. post free and the Canadian 12 cents post paid. Readers living in New Zealand, South Africa or Canada who require copies should send their orders to the addresses given below.

Readers living in countries other than those mentioned should order from Meccano Ltd., Binns Road, Old Swan, Liverpool, sending a remittance of 6d. with their order.

Overseas Agencies:

NEW ZEALAND: Models Limited, P.O. Box 129, Auckland (Third Floor Paykel's Building, Anzac Avenue).

SOUTH AFRICA: Arthur E. Harris, 142, Market Street, Johannesburg (P.O. Box 1199).

CANADA: Meccano Ltd., 34, St. Patrick Street, Toronto.

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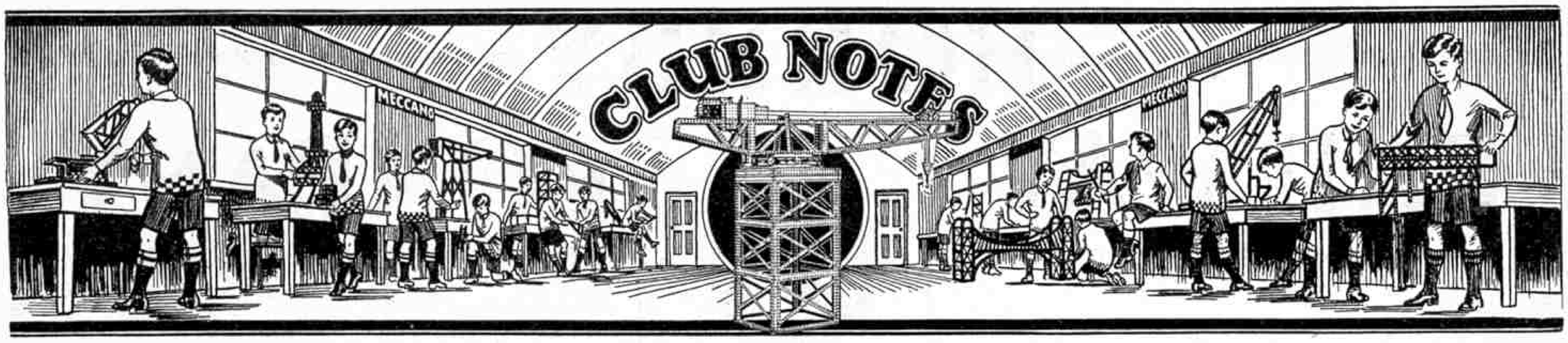
(Dept. A.M.), Old Swan, Liverpool



Whitgift School M.C.—J. D. Mellor, secretary for two years, has been compelled to resign owing to pressure of school work. A presentation has been made to him in recognition of his services, which have been largely responsible for the reputation of the Meccano Club of being the best organised society in the school. Visits have been paid to the works of Trojan Ltd. and the S.R. Signal Box at East Croydon, and a visit to the A.E.C. Works at Southall has been arranged. Club roll: 50. *Secretary:* M. M. Young, The Corrie, Manor Way, Purley, Surrey.

Greenford M.C.—Club work has been divided into six sections, an Assistant Leader being in charge of each. Members may join any of the sections, which are devoted to Handicraft, the Cinematograph, and Junior and Senior Electrical Model-building, in addition to Meccano Model-building and Hornby Train operation. Visits to the Rockware Glass Works and the South Kensington Science Museum have been arranged, and a tour of London is to be undertaken. Club roll: 20. *Secretary:* C. Howe, 145, Costons Lane, Greenford.

The Mall School M.C.—In addition to Model-building Contests the programme includes Treasure Hunts by torchlight—a very popular feature—Games Nights and a Mock Trial. A Lantern Lecture and a Cinematograph Display are to be given by a friend of Mr. W. A. Shearman, Leader of the club. The Annual Exhibition is to be held this month, and members have been busy building models and making other preparations. Club roll: 39. *Secretary:* K. Harrison, 51, Newry Road, St. Margarets, Twickenham, Middlesex.

Bridport Grammar School M.C.—Members have become specially interested in Photography, and Summer work in connection with this hobby has formed the basis of interesting discussions since the beginning of the present session. A series of Model-building Contests has been in progress since September. The entries are to be displayed at the Exhibition to be held this month. Membership is increasing, and Model-building is being specially encouraged by means of Competitions. The Library is being re-organised and a complete classified catalogue prepared. Club roll: 28. *Secretary:* R. Hyde, 6, Melville Square, East Street, Bridport.

Laindon M.C.—A talk on "*Levers*" greatly interested members and many experiments have been carried out with the aid of Meccano Strips to illustrate the uses dealt with in the talk. Interesting Competitions are regularly arranged in connection with demonstrations of this type. At another meeting the methods of printing stamps were studied. Talks on "*Signalling*" have been given, and a second Mock Broadcast programme has been held. Club roll: 11. *Secretary:* J. P. Tourle, "St Ives," Leicester Road, Laindon, Essex.

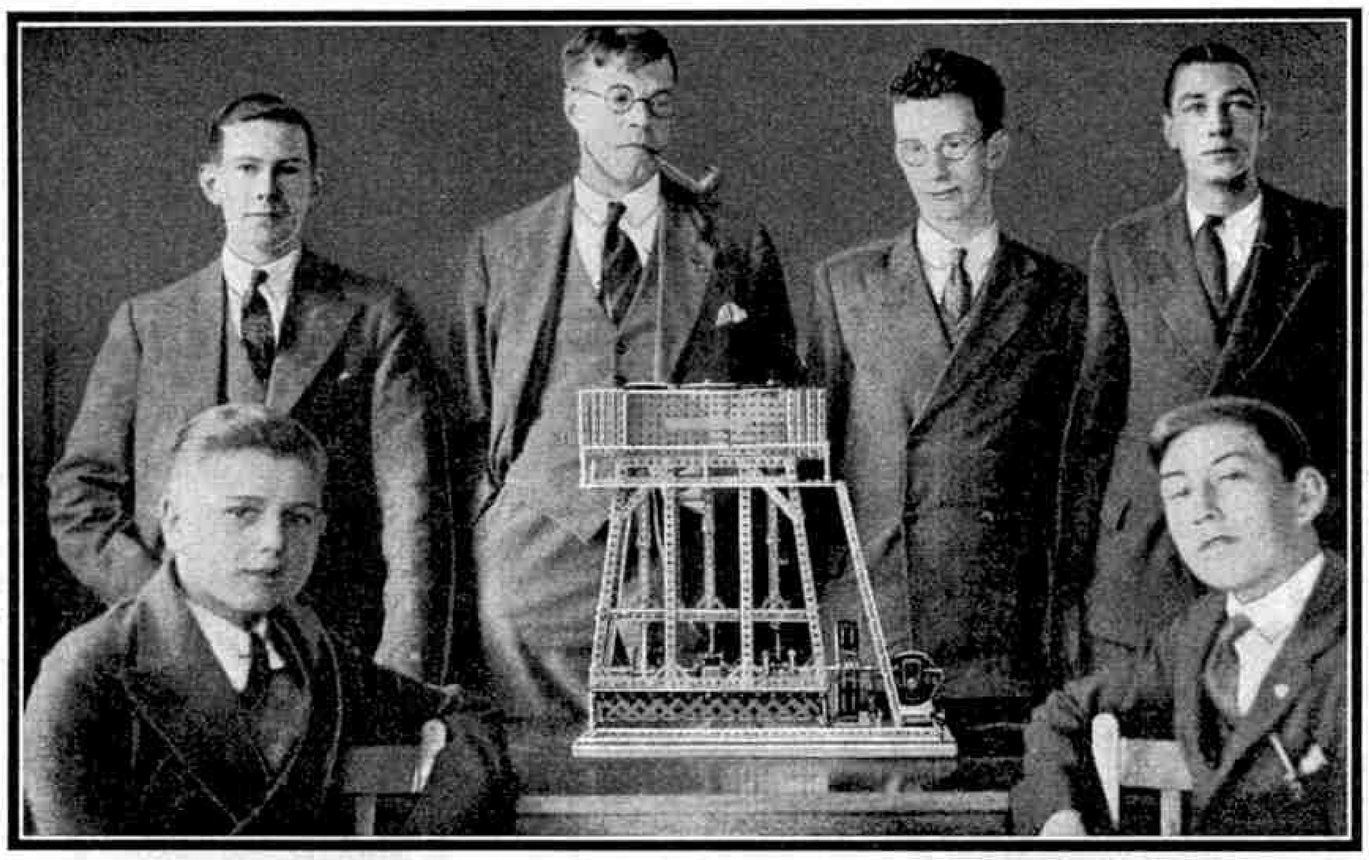
Bagshot and Lightwater M.C.—A very enjoyable Summer programme included a visit to the Tattoo at Aldershot and other excursions. Members have now settled down to indoor work. A Recruiting Campaign has increased the membership. The club's Certificate has been framed and new books have been purchased for the Library. Club roll: 12. *Secretary:* E. Hart, 3, Providence Cottages, Guildford Road, Bagshot, Surrey.

Wembley M.C.—Excellent meetings are reported. Members have been divided into two groups and all are extremely keen. Special interest is being taken in Hornby Train Evenings. A large track has been constructed and the capabilities of the locomotives available have been thoroughly tested. Club roll: 26. *Secretary:* E. Burns, 31, Oakington Manor Drive, Wembley Hill, Middlesex.

Middlesbrough M.C.—The Summer Session ended with the success of the "Clips" in the Inter-Section Cricket Competition for the Allick Shield. The Swimming Section also completed a good season, in which six members have been taught to swim. Model-building is now in full swing, Road Vehicles and Simplicity Models forming subjects in the first Contests. Exciting games of Blow Football ended in the "Clips" winning the championship. This section is leading in the Sectional Contests. Club roll: 40. *Secretary:* R. C. Rowlatt, 3, Blenheim Villas, Longlands Road, Middlesbrough.

Chertsey M.C.—Additions have been made to the club's Meccano Outfit, and a full catalogue has been prepared of the parts now available. A lecture of special interest on "*Tanks*" was given by Mr. L. Martland, Leader of the club, who is an engineer engaged in the production of vehicles of this type. A resolution has been passed forbidding yo-yo practice except on Games Evenings and at entertainments! On these occasions points will be awarded for the best performances. Club roll: 14. *Secretary:* V. Brown, Arbon Grove Cottage, Lyne, Chertsey, Surrey.

St. Peter and St. John's (Exeter) M.C.—Extensive Model-building operations are being carried on,



A group of members of the Westbury M.C. with their Leader, Mr. H. E. Taylor. Our photograph, for which we are indebted to the "Citizen," Letchworth, was taken during the Third Annual Exhibition of the club, at which a splendid display of models delighted a large number of visitors. The club was affiliated in December, 1926.

members having built a Perforating Machine for the club's extensive Workshops, in addition to Motor Lorries and a Meccano Rack for train name boards. The Workshops continue to work overtime, and the Revolution Counters have been busy registering the turns of the driving shafts. An event that greatly interested members was the successful repair of the club's typewriter with the aid of Meccano parts. This enabled publication of "*The White Triangle*" to be resumed. Club roll: 18. *Secretary:* Mr. J. Blaker, c/o 60, Elmside, Exeter.

AUSTRALIA

Melbourne M.C.—Outstanding events have included a demonstration by the secretary of a Railway Breakdown Crane, which readily replaced in position a Hornby Locomotive that had been derailed; and a talk by Mr. R. Pearson, President of the club, on his extensive collection of photographs of American locomotives. Visits have been paid to a Hobbies' Exhibition in Melbourne, the Clock Tower of Flinders Street Station, and the General Post Office, Melbourne. An Aeroplane Constructor Outfit has been purchased for the use of members. Club roll: 58. *Secretary:* L. Ison, 8, Hayes Street, Northcote, N.16, Victoria.

INDIA

Sind Madressah (Karachi) M.C.—Affiliation to the Meccano Guild has been secured and members are enthusiastic. Interesting lectures on "*Aeroplanes*" have been given by Mr. B. B. Thakur, who illustrated his talks with the aid of Meccano models. In a special Model-building Contest, entrants were required to submit reproductions of cranes. The models were judged by Mr. H. F. L. T. Harrison, B.Sc., M.R.S.T., Principal of the School in which the club has been formed, who has kindly agreed to become President of the club. Club roll: 12. *Secretary:* Akhtar Abbas, Faiz Hussainy Building, Kutchery Road, Karachi.

NEW ZEALAND

Christchurch M.C.—The chief recent event has been the celebration of the club's third birthday. An Exhibition of Models built by members and a large Hornby Train Layout were the chief features, and the display was visited by more than 120 people, including members of the Ashburton, Fendalton and Sumner Meccano Clubs. Other attractions included an interesting Cinematograph Display and music given by members of the local Y.M.C.A. Orchestra. At ordinary meetings, tests of scale speeds of locomotives have been made. Colour Light and Semaphore Signals have been added to the club's Hornby Train Layout, and these are operated from a central Signal Cabin. Club roll: 32. *Secretary:* E. A. Gay, c/o 625, Colombo Street, Christchurch.

Wellington M.C.—The working plan of the club has been carefully revised, and members, who have been divided into four sections, are entering whole-heartedly into the scheme, the central feature of which is the keeping of a record of every model built by each member, with the number of marks awarded him for it. A visit has been paid to the ferry steamer "*Rangatira*," which is on the service between Wellington and the South Island. A successful Exhibition of Models has been held. A large number of visitors attended in spite of bad weather, and commented favourably on the models on view and the Hornby Train operations carried out. Club roll: 17. *Secretary:* E. H. Speers, 70, Cuba Street, Petone, Wellington.

SOUTH AFRICA

Berea M.C.—More members have been enrolled and the club has been divided into two sections, representing Cambridge and Oxford respectively. Model-building Nights, Games Evenings and Visiting Nights have been held regularly and a determined effort is to be made to improve the standard of Model-building, in readiness for Competitions now being arranged. Club roll: 18. *Secretary:* D. Hilson, 8, Trematon Place, Park Town, Berea.

Simon's Town M.C.—The club is flourishing and recently 14 new members have been enrolled. Meccano Model-building and Hornby Train sections have been formed and members' parents and friends regularly visit the club room, which is always open to inspection during meetings. The excellent plan of winding up each meeting with Community Singing is followed. This helps to create a friendly atmosphere in the club. *Secretary:* L. Creasey, "Elsinore," Mount Pleasant, Simon's Town.

Clubs Not Yet Affiliated

Geraldine (N.Z.) M.C.—Excellent progress is being made. The club's Second Annual Exhibition attracted a large number of visitors, and was well reported in the "*Timaru Herald*." In addition to a large number of excellently built models, a miniature railway was on view. The scenery round the track was very realistic and included a river with real water in it. Proceeds amounted to £5 5s. 8d. The club's layout is being extended by the addition of 80 ft. of track, making a total of 240 ft. It is hoped shortly to secure affiliation with the Meccano Guild. *Secretary:* Mr. E. C. Stonyer, c/o Mr. E. O. Winmill, Hilton, Via Geraldine, New Zealand.

Western Province (S.A.) Preparatory School M.C.—An attractive display was given at the club's first Exhibition. The best model was an Aerodrome, equipped with Wind Indicator and protected by an Anti-aircraft Battery, at which three Aeroplanes were accommodated. This model was constructed jointly by five members. A mail train and several "specials" ran on a well-designed Hornby Train Layout, and an airmail line from the station to the Aerodrome was operated in connection with the mail train. *Secretary:* P. K. Wiener, Balcairn, Claremont, Cape Province, South Africa.

HORNBY RAILWAY COMPANY

JOIN THIS WORLD-WIDE FELLOWSHIP !

OPEN TO ALL HORNBY TRAIN OWNERS.

IT is now ten years since the introduction of Hornby Trains brought a new joy into the lives of thousands of boys in all parts of the world. In those days the Hornby railway system was on a small scale, but every year saw the addition of new locomotives, rolling stock, and points and crossings of all kinds with which to build up more interesting layouts. Along with the wonderful growth of the system went an increase in the numbers of the great army of Hornby Train owners and also in the enthusiasm with which they pursued their hobby.

Every one of the thousands of owners of Hornby Trains thoroughly enjoys the fun of running his splendidly appointed trains, headed by replicas of famous locomotives. But soon after their introduction the possibility of getting even more fun from them began to be realised.

An Organisation of Miniature Railway Enthusiasts

As is the case with most good things, the pleasure of running a miniature railway is greatest when it is shared with others who are equally enthusiastic, and in many letters from owners of Hornby railways the hope was expressed that steps would be taken to form an association to advise them and look after their interests. Mr. Frank Hornby, the inventor of Meccano and Managing Director of Meccano Limited, was equally desirous that everything possible should be done to enable boys to run their miniature railway systems to the greatest advantage. The result was that in October, 1928, the foundation was announced of the Hornby Railway Company, with Mr. Frank Hornby himself as President.

The new organisation was immediately successful in uniting the great army of Hornby Train enthusiasts. Its formation has stimulated the interest of miniature railway owners to such an extent that in the four years that have elapsed since its foundation, the membership has risen to more than 30,000. To-day boys are joining in increasingly large numbers, and during the last two months no fewer than 4,000 additional members of this splendid association have been enrolled.

Members of the H.R.C. are entitled to wear this badge which is beautifully enamelled in Colours

Members of local Branches of theHornby Railway Company have splendid opportunities of visiting engine sheds, goods yards and stations. The accompanying photographs —four of many forwarded to the Headquarters of the H.R.C.—show happy groups of members on interesting visits of this kind.

How to Become a Member of the Hornby Railway Company

Every boy who possesses a Hornby Train Set may become a member of the H.R.C. and thus become entitled to wear the badge of membership, which is beautifully enamelled in colours and has as its central feature a tiny representation of a train. All that he has to do is to fill in the application form—a copy of which is enclosed in every Train Set, or may be obtained from the Secretary of the H.R.C., Liverpool—and to return this together with a remittance of 6d. to pay for the cost of the badge. Immediately on receipt of the completed form the applicant is enrolled as a member of this great organisation, and a handsome certificate to that effect is forwarded to him along with his badge.

Members of the H.R.C. are entitled to many privileges. The chief aim of the Company is to enable its members to get as much fun as possible from their miniature railways. This can best be done by helping them to make their layouts and operations as realistic as possible. Competent railway experts on the staff at Headquarters therefore are continuously engaged in advising members how to improve their layouts, or how to make their operations more interesting and railwaylike, and generally how to make the best possible use of the material at their disposal.

The Secretary of the Company is in continual touch with members, and always is ready to assist and advise them in any difficulty, even if this is not directly associated with miniature railway activities. In addition, members may join the Correspondence Club, by means of which they are put into direct touch with enthusiasts in other parts of the world

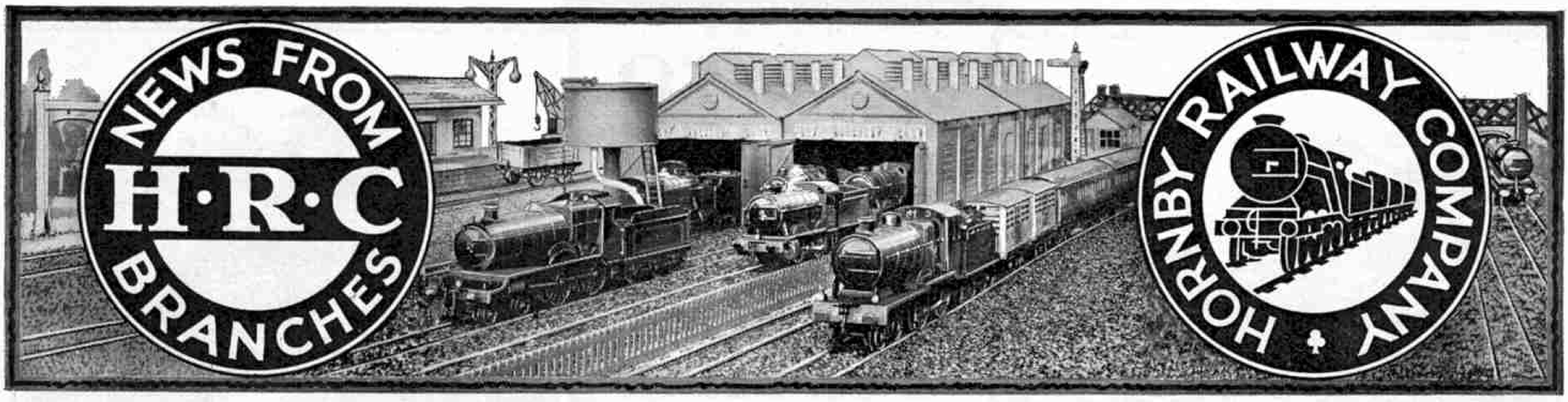
The Formation of Local Branches

The scope for enjoyment of the miniature railway hobby may be increased enormously by joining one of the many local Branches that have been formed in various parts of this and other countries. These are composed of Hornby Train owners who meet together for the purpose of carrying out railway operations on a more extensive scale than is possible for a single individual. With their combined resources large and interesting layouts are formed, and on these trains of all kinds are run exactly as are the trains on real railways. There is no limit to the amount of pleasure and interest that may be obtained in this manner. Every member of the H.R.C. should take steps to join a conveniently situated Branch immediately, or if one does not exist in his neighbourhood he should endeavour to find other enthusiasts to help him to found one.

The fun that members of local Branches of the H.R.C. may obtain is not limited to operations on the track laid out in the Branch meeting room. The four photographs reproduced on this page are proof of this. At the Headquarters of the H.R.C. an enormous number of similar photographs have been received, all of which have been taken during visits of members of local Branches to goods yards, engine sheds, and other places of railway interest.

A lone railway enthusiast usually must be content with what may be seen in stations and from the lineside, but members of the H.R.C. have the interest of responsible officials of the great railway companies. These cordially support the organisation and are eager to forward its chief objects. Consequently members have been given wonderful opportunities of learning the inner details of railway working. On their visits they have descended into the fire-boxes of the giants of the Iron Road, have peered into their smoke-boxes, gone into the pits underneath them in order to probe into their mechanism and generally have been given a thorough insight into railway operation and maintenance. Privileges such as these are valued highly by every boy interested in railways, and they are freely at the disposal of members of local Branches of the H.R.C.

The official organ of the "Hornby Railway Company" is the "*Meccano Magazine*," a special section of which is devoted entirely to the affairs of the Company. Brief reports are given of the progress of affiliated Branches, with special reference to any developments of unusual interest, and thus each Branch benefits by the experiences of others. In addition to the publication of Branch News and Notes, articles on miniature railway working in all its aspects appear regularly and every issue contains articles that appeal strongly to railway enthusiasts.



Branch Notes

FLIXTON WESLEYAN.—The railway material of the Branch has been thoroughly overhauled, and new rolling stock and engines have been purchased. A new track has been designed. The rails are fixed on boards to enable outdoor work to be carried on, and special cuttings, tunnels and stations for this purpose are being built by members. The library has been re-organised and efforts are now being made to obtain a room that can be transformed into a miniature railway engineering works. Secretary: J. P. Haworth, "Woodthorpe," Rothiemay Road, Flixton.

STREATHAM PARK.—The Branch layout has been re-organised to represent the track of the "*Sunny South Express*" from Liverpool to Hastings, and suitable timetables have been worked out. Trackwork is being steadily developed and members show great skill in operations. When the couplings of the Branch close-coupled train broke, the necessary repairs were carried out so quickly that only one minute was lost. A new activity is the production of a magazine known as "*The Rocket.*" Members are taking up individual model-making, and are busy with the production of various miniature locomotives and wagons. Secretary: P. J. B. Doyle, 177, Ribblesdale Road, Streatham, London, S.W.16.

BELFORT (CATFORD).—The Branch track consists of two terminal stations, situated in separate rooms, with a connecting main line. This layout lends itself to realistic working, which is carried out in strict accordance with good railway practice. At one track meeting a heavy goods train was despatched on the wrong line and collided head on with an express Pullman. The member responsible for the terrible catastrophe was immediately tried for manslaughter and negligence, and found guilty and sentenced to extra work for two weeks! Secretary: J. H. Forth, Gleneagles, 31, Ardoch Road, Catford, S.E.6.

HORNSEA.—The Branch is now strong in numbers, and members have been divided into five sections, known respectively as Junior Apprentices, Senior Apprentices, Engineers, Scientists and Old Boys. The 150th meeting was recently celebrated by a Cinematograph display, the subject being "*Motor Car Racing at Brooklands.*" The Branch track has been extended in order to include an additional station, and new timetables have been worked out. Cinematograph entertainments, football and indoor games are arranged regularly. Secretary: P. Thom, 5, Alex Road, Hornsea.

1ST BOLTON.—An attractive visit was paid to the Longsight engine sheds, where no fewer than 33 locomotives, including three "Royal Scots" and one "Claughton," were inspected. The next meeting of the club was devoted to an open discussion on things seen during this excursion. A talk on "*The Flying Scotsman*" has been given by the secretary, and other meetings have been devoted to talks on railway topics and work on the Branch track. This consists of a single line, and the staff system is in operation. A magazine is being produced and it is hoped to publish this monthly. Secretary: A. Ainley, 11, Stirling Road, Astley Bridge, Bolton.

WOODFORD.—Interesting changes in the Branch track have included the building of two new "halts" and the replacement of the old signalling system by one in which control is concentrated in one cabin. As a result, train work has been speeded up, and better service has been provided in the "district" through which the line runs. Some interesting lantern lectures have been arranged. Secretary: J. H. Skelt, Walberswick, Woodside Road, Woodford Wells.

A happy group of members of the South Wigston Branch, No. 227. Chairman, Dr. F. S. Poole; Secretary, H. H. S. Mansfield. This Branch was incorporated in May of this year and has made steady progress. An enjoyable programme of track meetings and railway visits is being followed.

AUSTRALIA

KEW.—Realistic working on a non-continuous double-track layout for clockwork trains forms the chief occupation at meetings. At one terminus there is a double-track electric extension, and the layout is sufficiently large to enable six clockwork engines and one electric locomotive to be employed, with a proportionate amount of rolling stock. Secretary: A. J. McCutcheon, 20, Studley Avenue, Kew, E.4.

NEW ZEALAND

CHRISTCHURCH.—A Lecture on "*Photographic Enlarging*" was given by the President of the Club, and was followed by practical work by members, the necessary apparatus and paper being kindly provided by the lecturer. The birthday of the club was celebrated by a display of clockwork and electric working on the Branch layout. Meccano models also were exhibited, and a Cinematograph demonstration was given by a representative of Kodak Ltd. More than 120 visitors were present. On a recent Competition Night members were required to copy a layout and to mark on their copies the positions of signals, stations and other accessories. Secretary: Mr. J. C. Fleming, 52, Cowlishaw Street, Avonside, Christchurch.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are now being formed, and boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership, and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

CASTLETON—R. H. Dickinson, Bryn Ivor Hall.

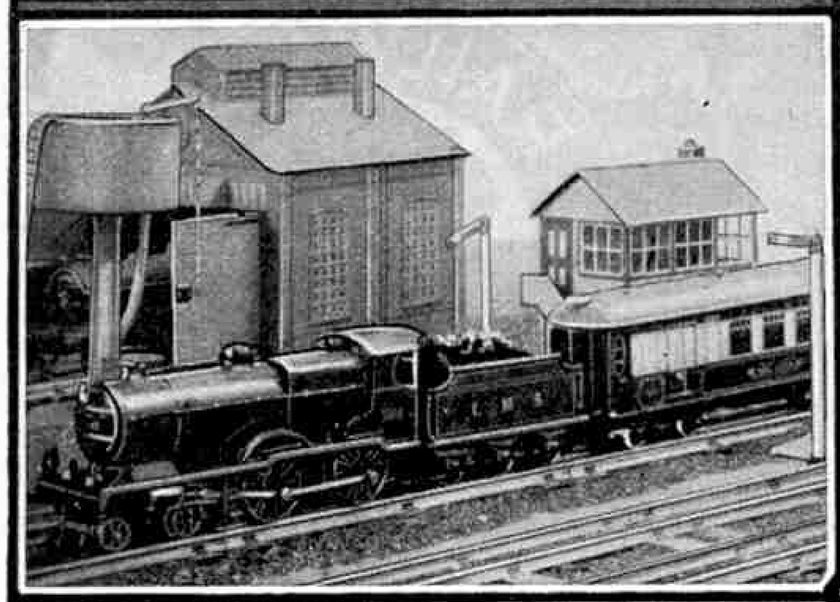
JERSEY—Richard L. Herbert, La Folie House, South Pier, St. Helier, Jersey, C.I.

LONDON—Mr. J. E. Dore, 31, St. Stephens Road, Ealing, W.13.

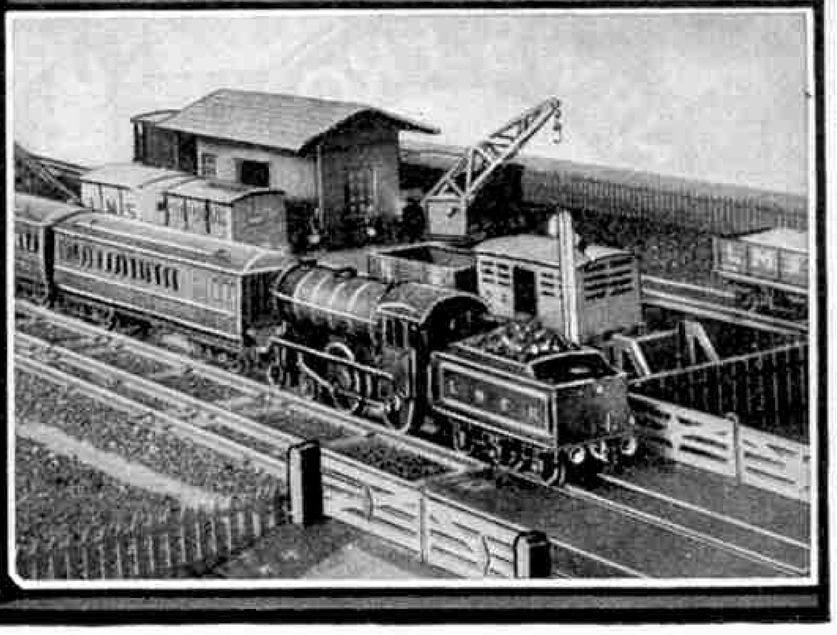
PERTH—J. Hetherington, 21, Darnhall Drive, Perth.

Branches Recently Incorporated

233. PARRAMATTA—Mr. H. H. Matthews, 27, Ross Street, Parramatta, N.S.W., Australia.
234. KILKENNY—Thomas G. Crotty, Newtown Manor, Kilkenny, I.F.S.
235. LEICESTER—Geoffrey B. Gibson, 49, Front Street, Birstall, Leicester.

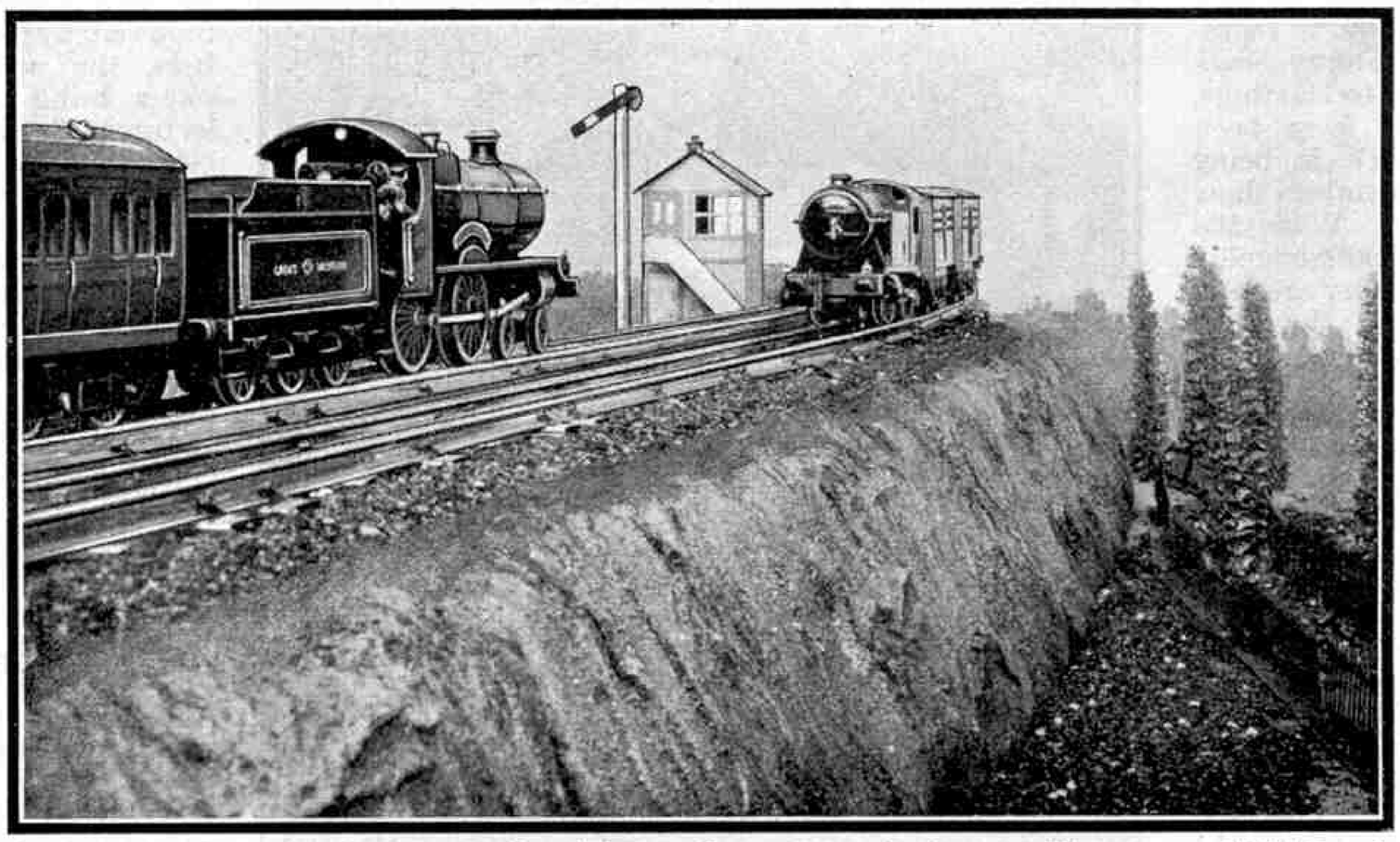


HOW TO GET MORE FUN FROM HORNBY TRAINS



L.—"BLACK COUNTRY" SERVICES

IN the early stages of the development of a miniature railway system, after the operation of the locomotives and the management of the trains generally has become familiar, the majority of railway owners usually turn their attention to examining the possibilities of layouts of different types. The advantages of various formations in the space available are noted, and features that prove to be of special value are incorporated in the final design in the case of permanent layouts, or in the plan most usually followed for temporary tracks. Up to this point the model railway is designed purely from the point of view of convenience in regard to railway-like operations in general. Many model railway owners do not pass beyond this stage, but the majority sooner or later begin to develop their layouts more or less on the lines of some familiar section of a real railway. There is no doubt that developments along these lines add greatly to the interest of any model railway, and we have referred from time to time in these pages to some of the possibilities.



An interesting photograph showing part of a miniature railway on an embankment. The presence of G.W.R. and L.N.E.R. trains suggests the joint line via High Wycombe referred to in this article.

There appears to be a widespread impression that the interest of main line working is largely confined to the long-distance services between places 200 or 300 miles apart. This impression no doubt arises from the fame attached to the famous long-distance trains of the four groups, but it should not be allowed to cause the shorter-distance main line services to be overlooked. From London, for instance, there are frequent and interesting services, in some cases by two routes, to such places as Birmingham, Bournemouth, Leicester, Cambridge, Brighton and Reading.

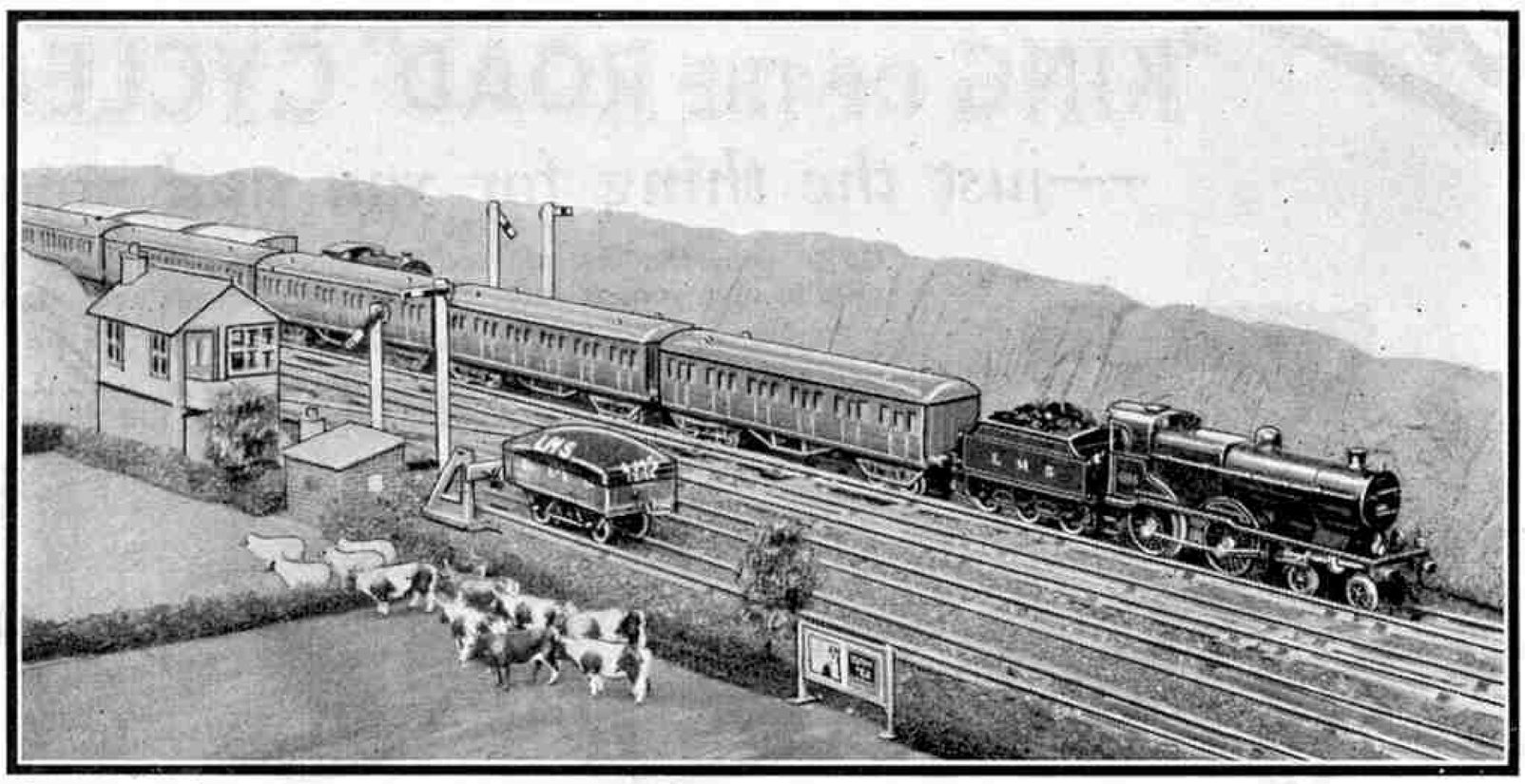
Let us consider the services between London and Birmingham provided by the G.W.R. and the L.M.S.R., which are of great interest to all model railway owners who possess locomotives and rolling stock of either of these companies. A splendid service of trains between the two cities is operated by both companies, and their two-hour timing has been a great feature for many years. This timing now includes several stops on both routes.

The operation of trains of this kind is particularly suitable for Hornby layouts where clockwork is the motive power as the length of run is necessarily limited but acceleration is rapid, and speed is well sustained until the closing stages of the run. Thus a Hornby No. 2 Special Midland Compound would be in its element at the head of a miniature flyer of this kind, and as a matter of fact the Birmingham and Wolverhampton service from Euston is handled almost exclusively by engines of the Standard Compound class. Remarkable feats are often recorded with loads suited to their capacity, and the miniature Hornby engine will respond in exactly the same way, provided that, like its big relation, it is well and carefully treated in the shed and on the road.

The centre-corridor coaches common in actual practice have their miniature counterparts in the Hornby No. 2 Saloon Coaches, or those who prefer Metropolitan Coaches for general use may make up their trains with these. Refreshment facilities are provided on certain trains, so that some coach windows may be covered with tracing paper, as frequently suggested in the "*M.M.*", to obtain the "kitchen window" effect. The presence on the platforms at the appropriate times of the necessary staff, contained in Modelled Miniatures Set No. 5, must not be overlooked.

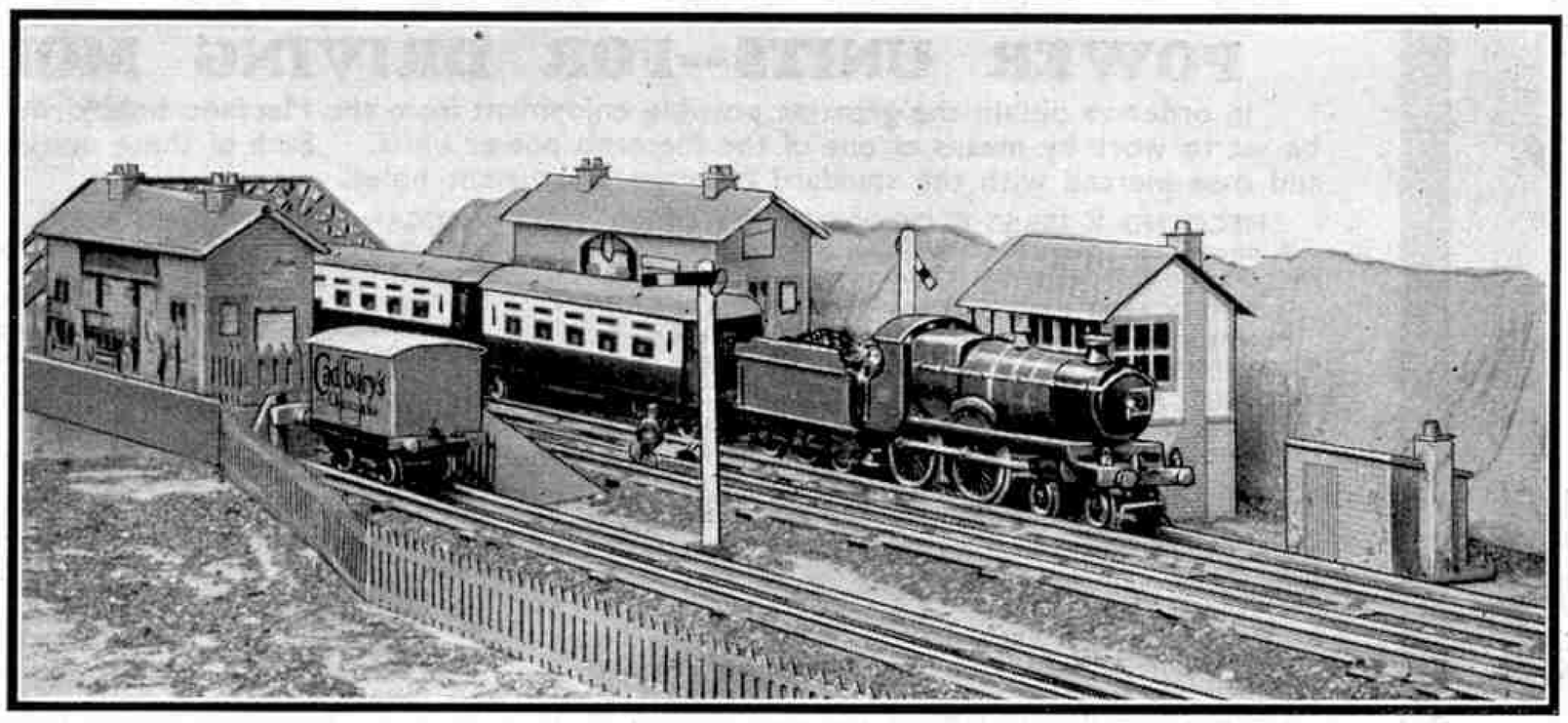
Readers who have travelled over the route will be familiar with its chief features. A reproduction of a section of Western Division main line, incorporating four tracks, would be spectacular, but there are not many enthusiasts who have the space for this. However,

as one of the accompanying photographs shows, several siding or loop roads, in addition to the main line, may give a "four-road" impression at certain points. The practice of placing fast and slow-line signals together is another feature, and is also illustrated in this photograph. Rugby is the point where the Birmingham and Wolverhampton route diverges from the Trent Valley line to Tamworth and Nuneaton, and if possible should be represented on the layout. A notable feature is the signal gantry south of the station with 44 semaphores—rather too many for the needs of a Hornby system! At the same time a Meccano gantry of similar style would be very effective and would give definite character to a miniature L.M.S.R. line at this point.



An express train hauled by a Hornby "Midland Compound." This is passing a goods train that can be seen refuged in the siding in the background.

Of the ramifications of the L.M.S.R. lines in the neighbourhood of Birmingham we can hardly make detailed mention here, but as two companies, the L.N.W.R. and the M.R. were concerned before grouping, the resultant maze is accounted for. Close interworking is now practised—this gives fuller scope for interest in miniature—and readers will remember that "*The Pines Express*" and "*The Devonian*" pass through the Birmingham district, the latter halting at New Street Station in both directions. Those interested in the varying routes taken by the former train should refer to the June, 1929, "*M.M.*" Mention of "*The Devonian*" reminds us of the Derby to Bristol main line of the Midland Division, and suggests a further possibility in the incorporation of this line, or part of it, in the general plan, joining up with the London to Wolverhampton section in a suitable manner. Lack of space would probably interfere with the proper development of this plan, however.



A G.W.R. express passing a country station. The engine is a Hornby "County of Bedford," and the No. 2 Pullmans are arranged to represent the articulated set of a G.W.R. Birmingham and Birkenhead express.

It was not until July, 1910, that the G.W.R. were able to introduce the two-hour schedule, which always occurs to mind as a standard for Birmingham trains. The shortened route by means of the joint line with the L.N.E.R. (G.C. section) from Northolt Junction to Ashendon Junction put the G.W.R. in a position to compete for the traffic, and the result is seen in the service afforded to-day. For numerous points of interest readers cannot do better than consult the chapter on the "*Birkenhead Diner*" in Mr. C. J. Allen's book "*Famous Trains.*" The train is the 6.10 p.m. from Paddington, and runs via the joint line through Bicester and Banbury, stopping at Leamington. The G.W.R. Birmingham Station at Snow Hill is the next call, and then Wolverhampton, where engines are changed and the train formation is modified for the next stage to Chester and Birkenhead.

The make-up of a miniature "*Birkenhead Diner*" would be interesting in that the restaurant portion of the actual train is composed of articulated units, and the same scheme can be employed in miniature. Hornby No. 2 Pullman Coaches represent G.W.R. stock quite well—if preferred enthusiasts can paint out the Pullman decorations on the lower panel—and the method of effecting the articulation was described in the "*M.M.*" last April. Drawn by a Hornby "County" or "Caerphilly Castle" Locomotive, such a train would look very well, and would enable a G.W.R. system to reflect the characteristics obtaining in actual practice. For the latter part of the run from Wolverhampton involving several stops, if this portion of the line is included in the general scheme, one of the smaller G.W.R. engines of the Hornby Series may be used as the train load is reduced. A No. 1 or No. 1 Special Tender Engine would be suitable, according to the provision of motive power on the line.

The joint section of the route, which is also used by L.N.E.R. trains running via High Wycombe, suggests the operation of the trains of both companies, as dealt with in the "*M.M.*" last month, and one of our illustrations shows the possibilities in this direction. A G.W.R. express, "County" hauled, is passing an L.N.E.R. local goods in charge of a No. 1 Special Tank belonging to that company.

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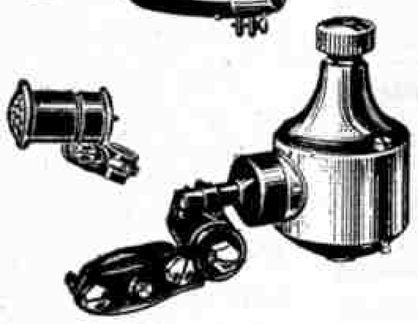

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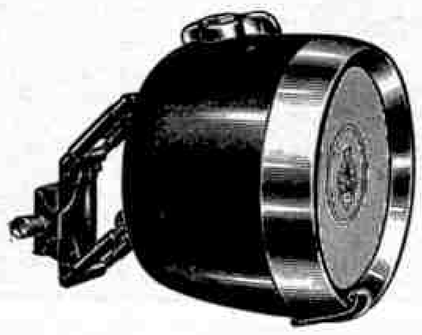

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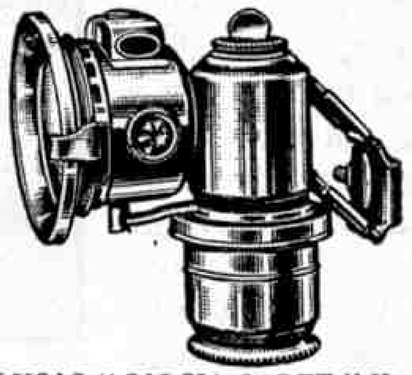

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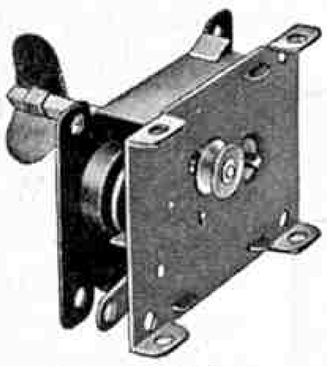
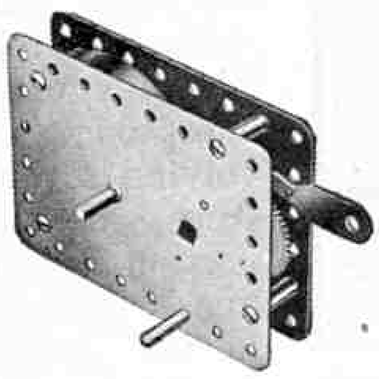
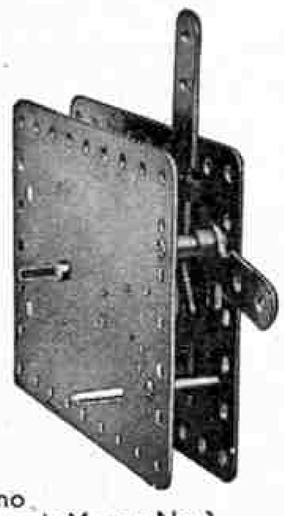


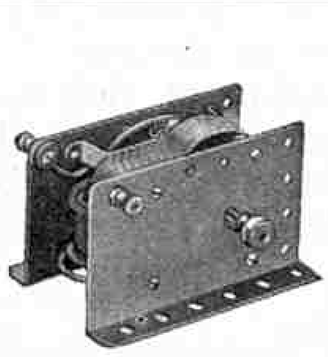
Meccano X Series Clockwork Motor



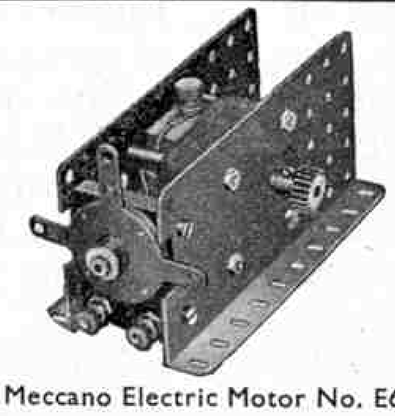
Meccano Clockwork Motor No. 1



Meccano Clockwork Motor No. 2

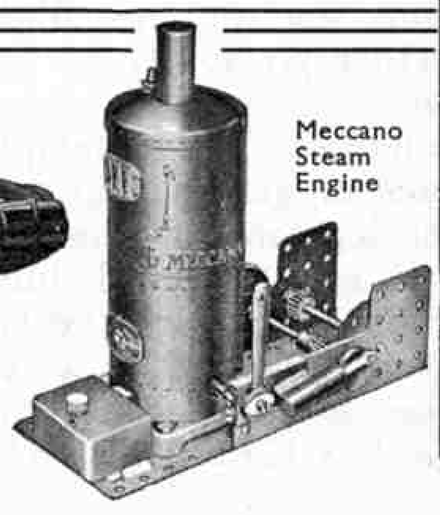


Meccano Electric Motor No. E1



Meccano Electric Motor No. E6

Transformer No. T20



Meccano Steam Engine

Pullmans in the Hornby Series

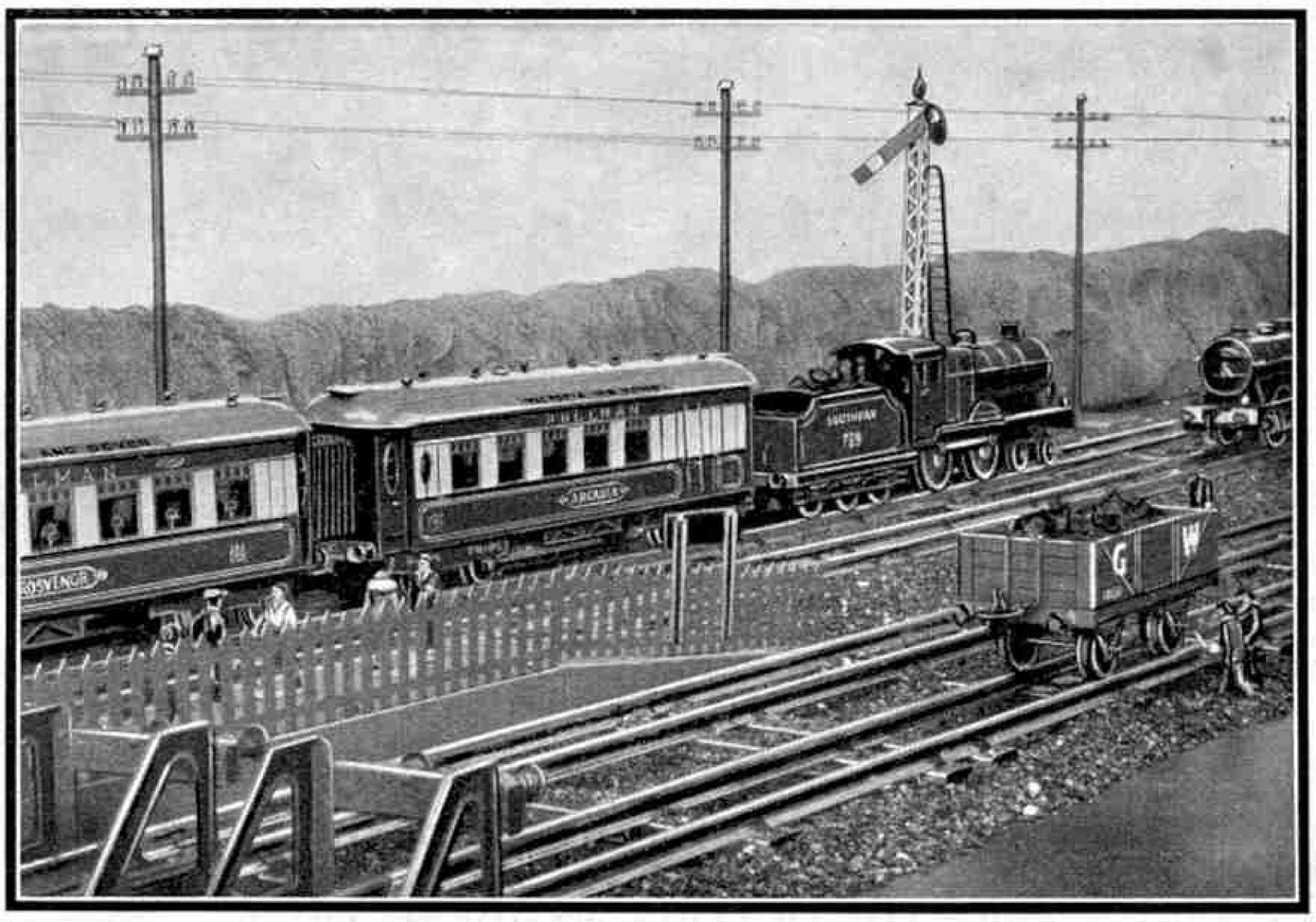
By "Tommy Dodd"

THE word "Pullman" is familiar enough to readers, and immediately suggests a long, luxurious bogie coach of distinctive construction, attractively finished in the umber and cream livery of the Pullman Car Company or the miniature counterparts of such vehicles available in the Hornby Series. We owe the Pullman car to George M. Pullman, an American of Chicago, whose experiences when travelling by night during the fifties led him to devise a type of coach that would provide improved accommodation and comfort for those who were willing to pay for it. After preliminary experiments, the Pullman Car Company of America was incorporated in 1867 for the purpose of building and operating luxury coaches for day and night travel over the American railways.

The scheme rapidly became popular in the United States, and in 1874 it was introduced into England. In that year 18 Pullman cars of American build, but erected in England, were put into service on the former Midland Railway. The L.B.S.C.R. introduced Pullmans in 1875, and from these beginnings have sprung the present-day "*Southern Belle*," "*Golden Arrow*," and "*Queen of Scots*" services, in addition to the numerous cars operated individually by trains of ordinary vehicles. Pullman passengers usually are required to pay a supplementary fare for the use of the cars, in addition to the normal fares. This does not apply on the L.M.S.R. in Scotland, however, where the Pullman restaurant cars are available for first and third-class passengers for meals without supplementary fares. On the Southern Railway, too, certain special facilities are offered at inclusive rates, which cover the Pullman charge.

The Hornby No. 2 Special Pullman is available in two forms, as an ordinary Pullman coach and as a composite vehicle with guard's and luggage accommodation. Complete Pullman trains are thus readily made up with a composite car at each end. A distinctive feature of Pullmans is the fact that the sides are straight and the solebar forms an integral part of the body construction. In this feature they show their American origin, as also in the provision of doors only in the end vestibules. The earlier Pullman cars had much of the traditional American appearance about them, but the later British cars have been developed on characteristic lines especially as regards the roofs and the bogies.

The Hornby No. 2 Special Pullmans follow the general design of the latest vehicles, and are remarkably realistic in appearance. The window mouldings are neatly embossed, so that the characteristic "squareness" of Pullman sides is reproduced. The vestibules are arranged with steps and opening doors, and communication with adjacent vehicles is possible by means of realistic corridor connections very similar to the actual Pullman gangways. Special bogies with equalised side frames and Mansell wheels ensure smooth running. These bogies represent those in use on all the latest Pullman stock.



A Hornby all-Pullman express at speed. The composite type of vehicle shown next to the engine enables complete trains to be made up with guard's and luggage accommodation at each end as in actual practice.

The distinctive pattern of roof with domed ends sloping down to the vestibules is copied, and neat miniature ventilators provide the finishing touch. The fascia or top rail of the coach above the windows is painted umber, as are the lower panels and the vestibules, cream being used for the panels at window level only. The grey shade of the roof was adopted on the recommendation of the Pullman Car Company, as representing the average condition of car roofs in service, though these are white when fresh from the shops. Automatic couplings and destination board brackets are further refinements, and complete an item of miniature rolling stock of the highest quality.

The internal decorations and appointments of real Pullman cars are a notable feature, and of these the neat table lamps give a characteristic appearance when the car is seen from the outside. In the Hornby vehicles the transparent window strip imitating glass has representations of these lamps printed on it at intervals at the appropriate height.

Less elaborate in style, though still very satisfactory, are the No. 2 Pullmans. They are of straight-sided, vestibuled construction, and can be joined up by corridor connections in the orthodox manner. Their roofs are correct in shape, but are not fitted up in such detail as those of the No. 2 Special type. They run on bogies that closely resemble the more or less American type of bogie, with outside equalising bar and coiled springs, that is found on older Pullmans. They are not supplied with Mansell wheels, but they can be so fitted by their owners if required. Their running is rendered extremely smooth where this plan is followed.

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COUNTRYSIDE SECTIONS

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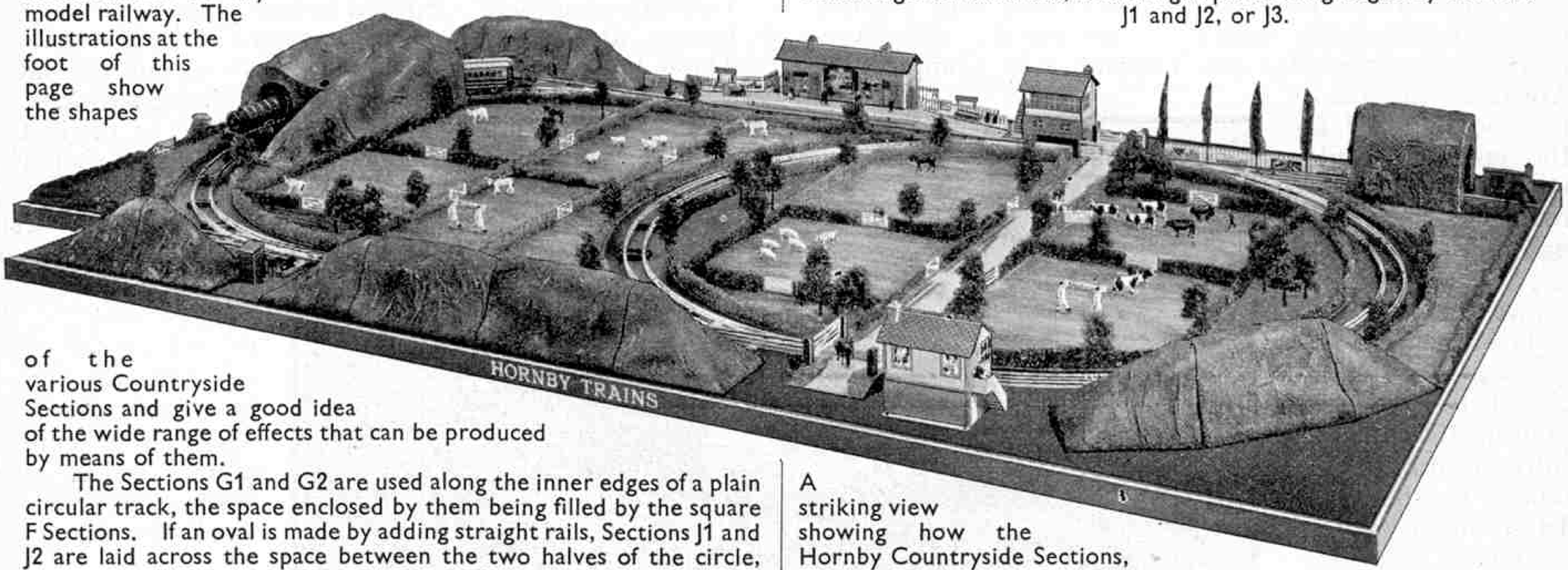
The new Hornby Countryside Sections provide model railway owners for the first time with scenery in a ready-made form that is suitable for any kind of 2 ft. radius layout. Splendid scenic effects may be obtained by arranging the Countryside Sections round a layout, and inserting here and there the Hornby miniature animals—cows, sheep, horses and pigs—Modelled Miniatures No. 2. The realistic effects produced in this manner add enormously to the attractiveness of any model railway. The illustrations at the foot of this page show the shapes of the various Countryside Sections and give a good idea of the wide range of effects that can be produced by means of them.

The Sections G1 and G2 are used along the inner edges of a plain circular track, the space enclosed by them being filled by the square F Sections. If an oval is made by adding straight rails, Sections J1 and J2 are laid across the space between the two halves of the circle, their number corresponding to the number of rails added.

The No. 1 Level Crossing necessitates the use of road Section H, the breadth of which is equal to the length of the Crossing. Similarly a half-rail requires the narrow field Section J3. Section H fits under the sloping approach of the Crossing, and a packing piece R is used on the opposite side to preserve the level.

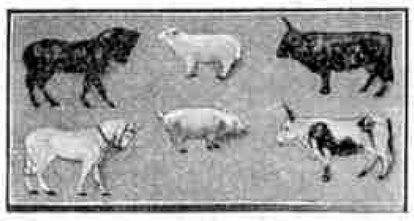
Triangular Sections K1 and K2 fit between the arms of the Right-Angle Crossing, so that "figure eight" layouts can be easily made up.

Curved Sections L1 and L2, and M1 and M2, are available for the outer edges of the track, the straight parts being edged by Sections J1 and J2, or J3.



A striking view showing how the Hornby Countryside Sections, Cuttings, and Tunnels may be applied to a layout is given in the above illustration.

Ask your dealer to show you the new Hornby Countryside Sections



MODELLED MINIATURES No. 2
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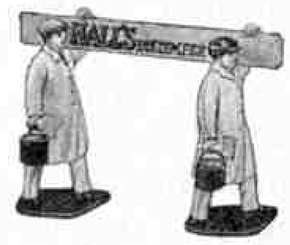
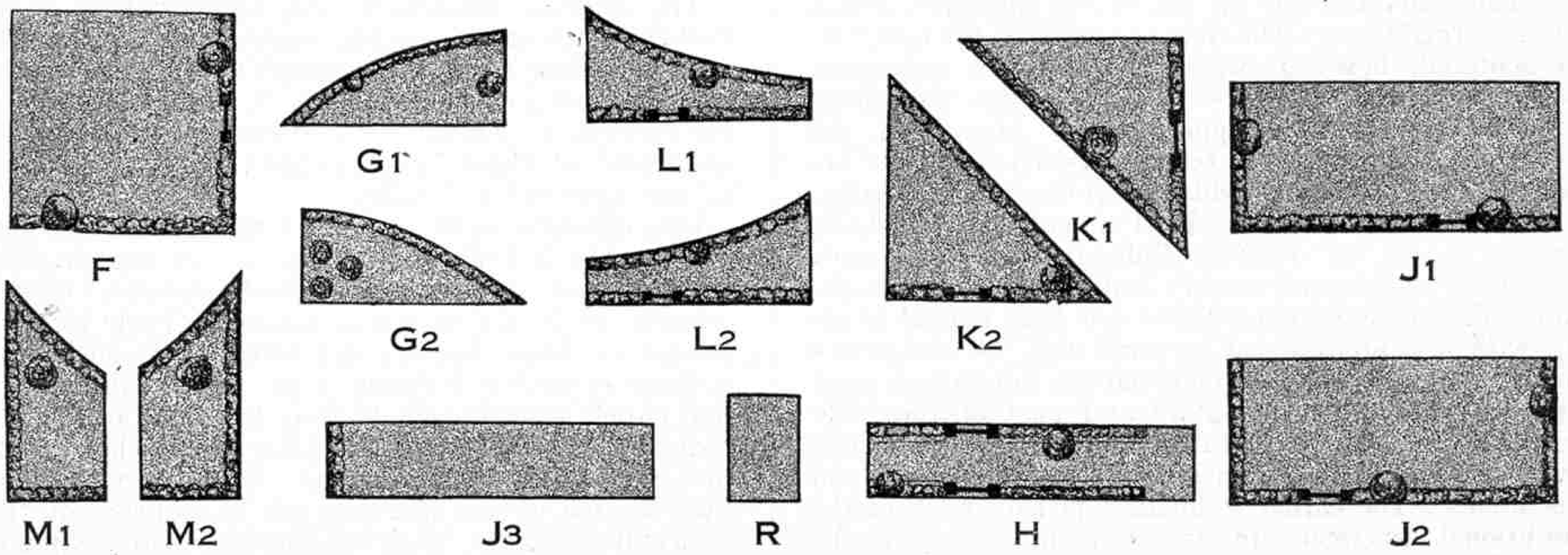
Fields G1 and G2	...	Box of eight (four G1 and four G2)	... 11/–
Roads H and Supports R		Box of two H with R Supports ...	... 5/6
Fields J1 and J2 ...	...	Box of four (two J1 and two J2)	... 11/–
Fields J3	...	Box of two	... 2/–
Fields K1 and K2	...	Box of four (two K1 and two K2)	... 8/–
Fields L1 and L2	...	Box of four (two L1 and two L2)	... 7/–
Fields M1 and M2	...	Box of four (two M1 and two M2)	... 5/–



MODELLED MINIATURES
No. 13
HALL'S DISTEMPER ADVERTISEMENT
This miniature of a well-known lineside advertisement is intended to be placed in the fields adjoining the railway track. **Price 9d.**



MECCANO LTD. OLD SWAN LIVERPOOL

Suggested Hornby Train Improvements

THE HORNBY LEVEL CROSSINGS

One of the most effective accessories that can be added to a layout is a level crossing, by means of which a miniature road is led over the railway track. These crossings are familiar enough in country districts, and few of our readers have not had to wait for the train to pass at one time or another. Such crossings are as a rule simple, and their usually single gates are operated by hand by one of the staff if a station is near, or by a crossing keeper accommodated in a hut. Main lines, too, pass such crossings, though in more recent times important roads are led across the track by an over or under-bridge as the case may be. Double gates are often used for main line crossings, and their operation is usually carried out from the adjacent signal cabin. The gates are interlocked with the signals so that the latter cannot be operated until the gates are secured against road traffic and so that the gates cannot be operated unless the signals protecting the crossing are at danger.

The Hornby Series contains several varieties of Level Crossings, and of these the largest is the No. 2 type. This is made to suit the standard Double Track, and when considering its addition to a layout it is useful to remember that its length, 10½ in., exactly corresponds to that of a standard length of Hornby Double Track. It can therefore be made use of with little trouble where an existing line is being altered, and its incorporation in a new plan involves no trouble whatever. Double gates are provided on each side, and are so placed that they are completely shut and locked against road or rail traffic as required. The crossing is made to slope down on each side to join the miniature road that may be a feature of the lineside at the point in question.

Similar characteristics make the No. 1 Level Crossing very suitable for smaller layouts, or branch lines, where a single track is laid. The length of this crossing also corresponds to a definite unit of Hornby track, being equal to a standard straight half rail. For the greater convenience of those who require to add the No. 1 Level Crossing to their layouts an extra half rail is packed with each of these accessories, so that the two together may replace a standard full length straight rail. Where the crossing is added to one side of an oval, the half rail may be added to the other side so that the two correspond.

Both the No. 1 and No. 2 Level Crossings are available fitted with special third rails for electric traction. In actual practice the conductor rails would stop short of the crossing, but the third rails are necessary in miniature as the gap left if the Crossing were without them would not be bridged by the two collector shoes of a Hornby Electric Locomotive, nor could a train be relied on to have sufficient momentum to carry it over the crossing. In this form they are known as Level Crossings E1 and E2 respectively.

A further refinement is available in Level Crossings E1E and E2E. These are the electrical No. 1 and No. 2 Level Crossings fitted with suitable lamps and wiring to enable them to be lit up at night. The red diamond in the centre of each gate that serves to indicate danger in the daytime is thus replaced at night by a lamp showing a red light. Suitable plugs are fitted for the electrical connections to the Distribution Box where several accessories are lighted from the same source, or to an independent supply.

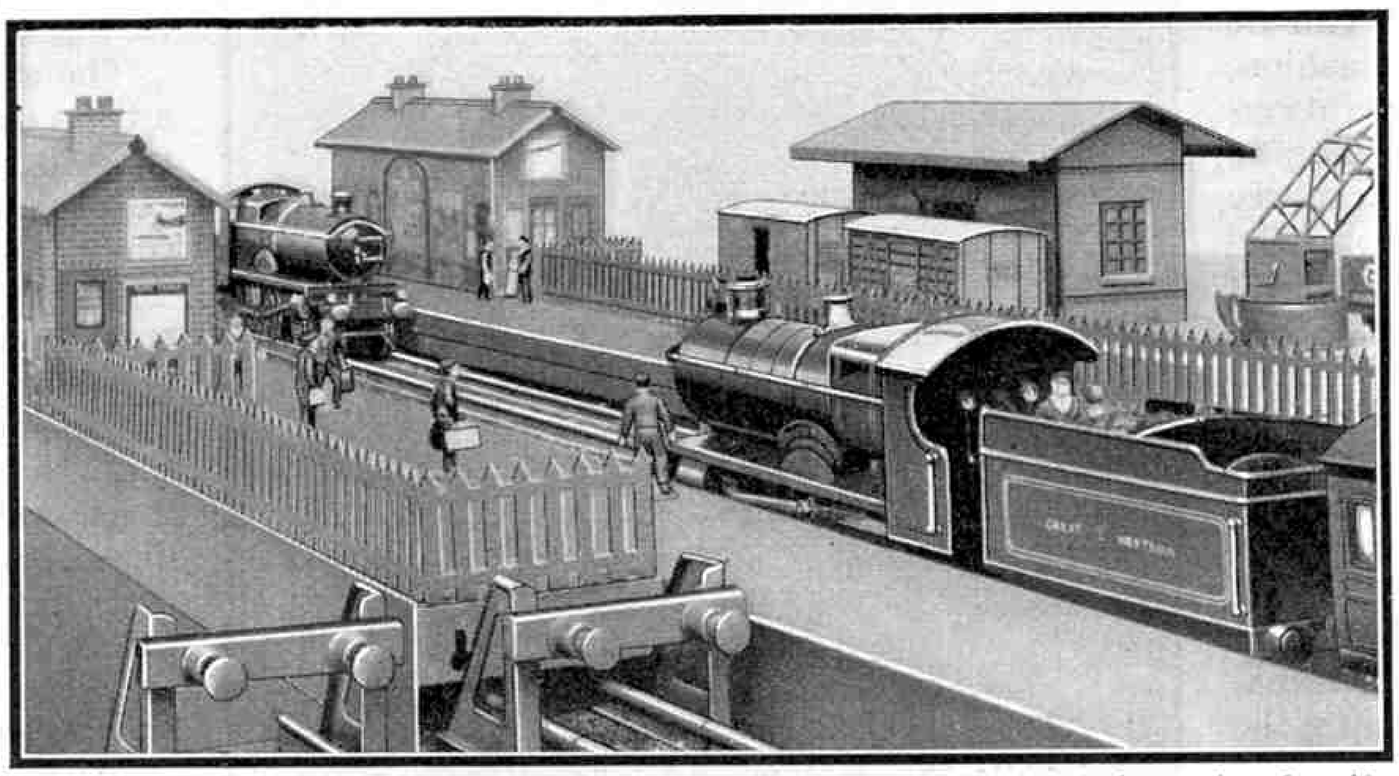
The M Level Crossing is of neat design and is suitable for single-track lines of the simple variety usually provided for M Locomotives and trains. It is very effective in use, and agrees very well with the general style of the M Series accessories, the chief points of which were described on this page last month.

It has several times been suggested that we should make the gates of the Hornby Series Level Crossings suitable for mechanical operation from the Signal Cabin by means of the Hornby Control System. This would appeal to some enthusiasts, but the necessarily increased price would be an objection, and we have found that to most model railway owners a great deal of the fascination of the Level Crossing lies in opening and shutting the gates by hand.

CURRENT DISTRIBUTION ON ELECTRIC LAYOUTS

It is sometimes found on extensive electric layouts that the speed of the train is reduced when passing over parts of the line remote from the point where connection is made to the power supply. This is due to a slight drop in voltage that may occur owing to the resistance of the rails themselves and the number of contacts at the numerous rail joints on a large layout. The reduction in speed so caused is frequently very puzzling, particularly to those who have not had a great deal of experience with electric traction. Fortunately the remedy is simple, the method adopted being to apply another Terminal Connecting Plate at the part of the track affected by the drop in voltage, and to connect the terminals of this to the Accumulator or Transformer and the Resistance Controller, in exactly the same manner as the first Terminal Connecting Plate is joined up.

The wire used should be the usual flex employed for making electrical connections on Hornby electric railways, and may be laid alongside the track. A tidy appearance will be given if these wires are neatly secured to the baseboard by small clips made of tinplate, or by drawing pins with the wires passing under the broad head of the pin. If preferred the wires may be taken across the intervening space instead of following the track, but this is not always possible where various landscape features or accessories are incorporated in the centre of the layout.



A realistic photograph of a typical station on a Hornby layout. A stopping train is entering alongside the near platform, while an express is passing through in the opposite direction.

CANADIAN NATIONAL LOCOMOTIVES.—We agree that miniature locomotives based on C.N.R. prototypes would be very impressive in the Hornby Series. Certain rolling stock already in use might be adapted, and you are no doubt familiar with the various American vehicles introduced some time ago. A suitable Canadian or American locomotive would be useful and attractive, however. It must be remembered of course that a true-to-type reproduction of a modern American 4–6–4 or 4–8–4 locomotive would require very large radius curves. Although we cannot undertake to introduce an American-type engine at present, we hope to deal with the question of train operations with American Rolling Stock of the Hornby Series in the near future. (*Reply to J. A. Hall, Corstorphine.*)

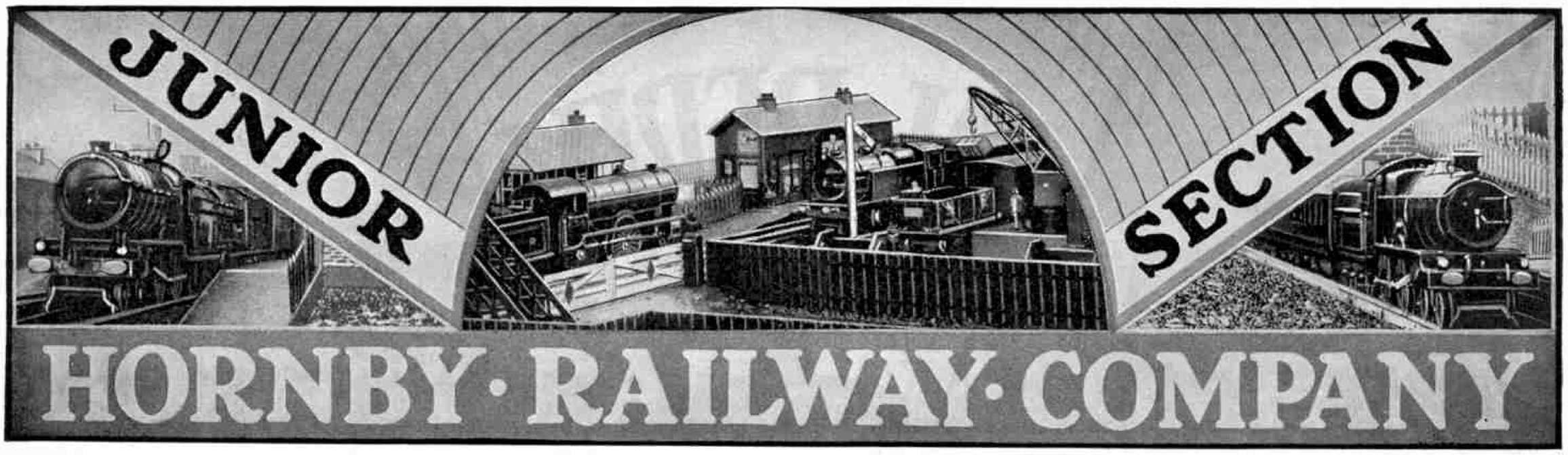
ROUTE DISCS.—Your suggestions are interesting and are no doubt prompted by the practice of the S.R. near which you live. Suitable miniature discs may be introduced later, but their provision would necessitate additional brackets on the engines in order to follow real practice. For the time being you can cut them from white cardboard, suitable loops being stuck on behind to enable them to be attached to your engines. (*Reply to B. Jones, Woking.*)

BRAKE PIPES TO COUPLE UP.—It is not impossible to produce miniature brake pipes to couple up, but there are several reasons why we do not fit these to the various items of rolling stock in the Hornby Series on which their use would be appropriate. Owing to the comparatively sharp curves of miniature railways coaches cannot be coupled up very closely, so that if brake pipes were arranged between them they would have a very untidy appearance and would not reproduce the neat loops and bends of the real thing. Again, the pipes would have to be fairly robust to stand constant coupling and uncoupling, and the fittings would be necessarily somewhat clumsy. Where corridor connections are in use throughout the train, small details such as brake pipes would be largely hidden by them. There is also the question of cost, and we doubt whether most Hornby Train owners would be in favour of their introduction in view of the increased prices that would be necessary for rolling stock fitted with them. (*Reply to T. Owen, Yeovil.*)

SIDE-DISCHARGING HOPPER WAGONS.—We agree that a miniature train of these would make a very impressive sight on a Hornby railway, but the cost of introducing such wagons as the L.M.S.R. ones you refer to would be considerable. It is doubtful whether there would be at the present time sufficient demand for such vehicles, as they are by no means typical of British practice. If they become generally adopted we shall consider them in due course, but for the present you will have to use the existing Hopper Wagons, which are very satisfactory and, being four-wheelers, take up less space than the larger eight-wheeled variety would do. (*Reply to F. Nesbit, Birmingham.*)

S.R. "E1" and "D1" REBUILT 4-4-0s.—Your remarks are interesting, and we agree that S.R. enthusiasts would probably welcome miniature reproductions of these engines. The similar but larger "L1" locomotives are already included in the Hornby Series, and represent more recent practice. Could you not adopt one of these for your particular purpose, using an L.N.E.R. tender which, as you point out, resembles that fitted to many Eastern Section engines? (*Reply to V. Dane, Tonbridge.*)

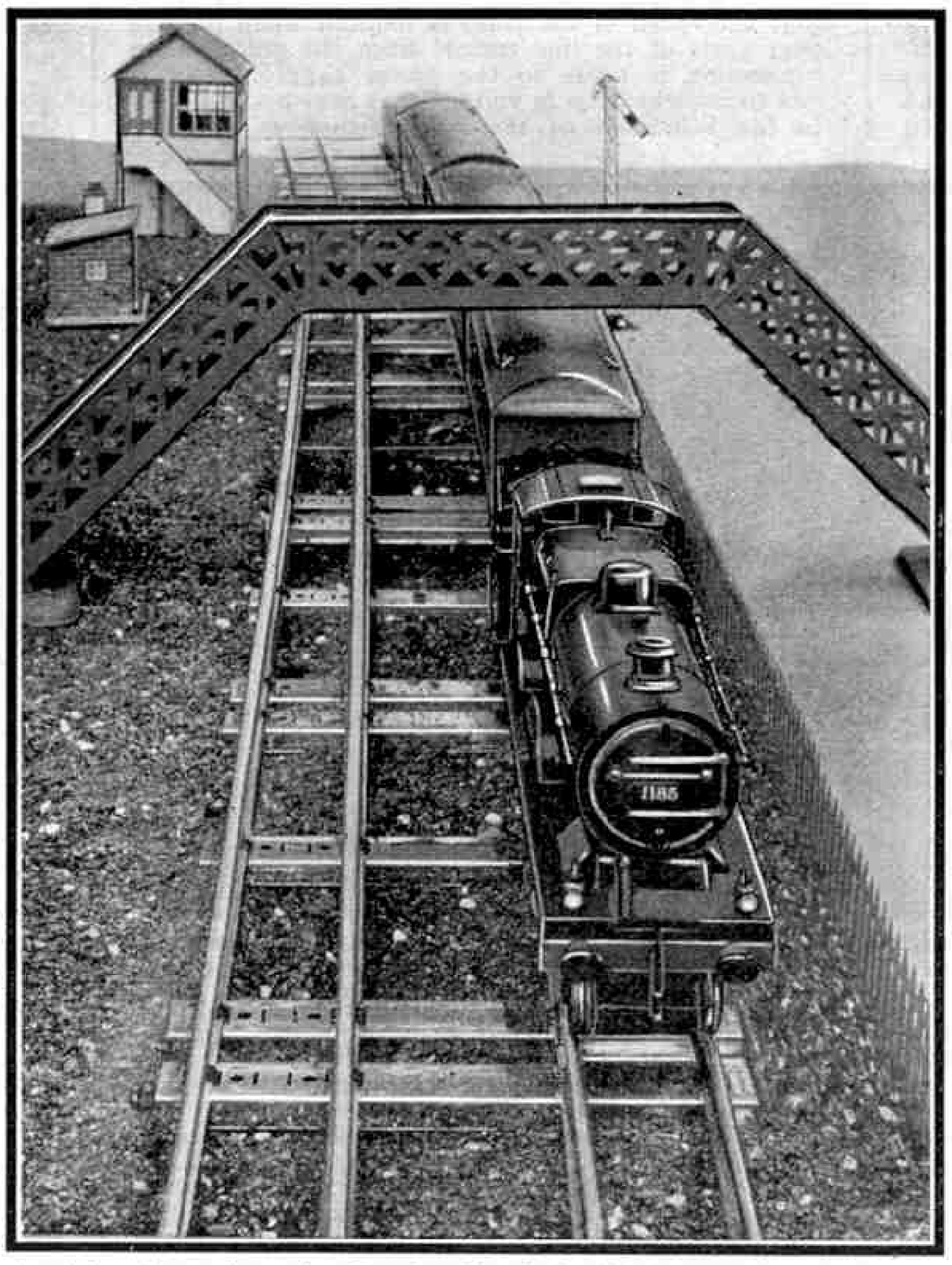
ELECTRICALLY-OPERATED TURNTABLE.—We do not think that an elaborate and therefore costly accessory of this kind would find many supporters among Hornby Railway enthusiasts. We admit that such a piece of apparatus would be a very fascinating addition to a system, but we suggest that the best scheme for those who require such turntables is to carry out suitable installations for themselves, using Meccano parts and employing a Meccano Motor to provide the drive through suitable gearing. (*Reply to F. Charlton, Ashford.*)



XLVIII.—A USEFUL LAYOUT PLAN

AS far as can be judged from our correspondence, the majority of Hornby Railway owners prefer some form of continuous layout, as providing the greatest opportunities for satisfactory running in a limited space. Such a layout is extremely interesting, and provides a vast amount of fun and excitement. We are anxious, however, that the special possibilities of terminal-to-terminal running should not be overlooked. With a plan that incorporates such working, arrivals and departures can be made in railway-like fashion, and the whole of the operations can be conducted according to timetable. Every model railway that has developed beyond the stage of the simple circle or oval should include at least one terminal station, even though the main line is of the continuous type.

Many exceedingly interesting layouts are arranged on what we might call the "there and back" principle. The train starts from the single terminal station, and after traversing the main line returns to its starting point, the distance being arranged to be covered on one winding of the engine if clockwork is employed as the motive power. The interest of a scheme of this kind is further increased if passing stations can be incorporated, but here space limitations often impose severe restrictions if they do not prevent such developments.



An interesting view of a Hornby No. 2 Special Locomotive, L.M.S.R., on an express train. These engines are close reproductions of the prototype.

Perhaps the best layout, where there is a reasonable but strictly limited space available, is one that provides start-to-stop working, and yet makes continuous running possible in addition when required. An interesting method of securing this result is shown in the accompanying layout diagram, which illustrates the system developed by M. Wormald of London, who is an enthusiastic H.R.C. member. In planning this layout his object was to secure a continuous run, combined with the ability to start the train from the terminus and let it return in due course to complete its journey. The main line itself is of the usual and convenient oval form, and it includes one passing station with a terminal road. The terminus station A is situated on a branch thrown off from a corner of the main line. Several sidings are provided, and their disposition is made clear by the diagram. The terminus has two platform roads connected by a facing crossover at the departure end, so that, if required, trains may depart or arrive at either platform. One road is extended beyond this crossover, and forms a useful spur for engines waiting to back on to their trains.

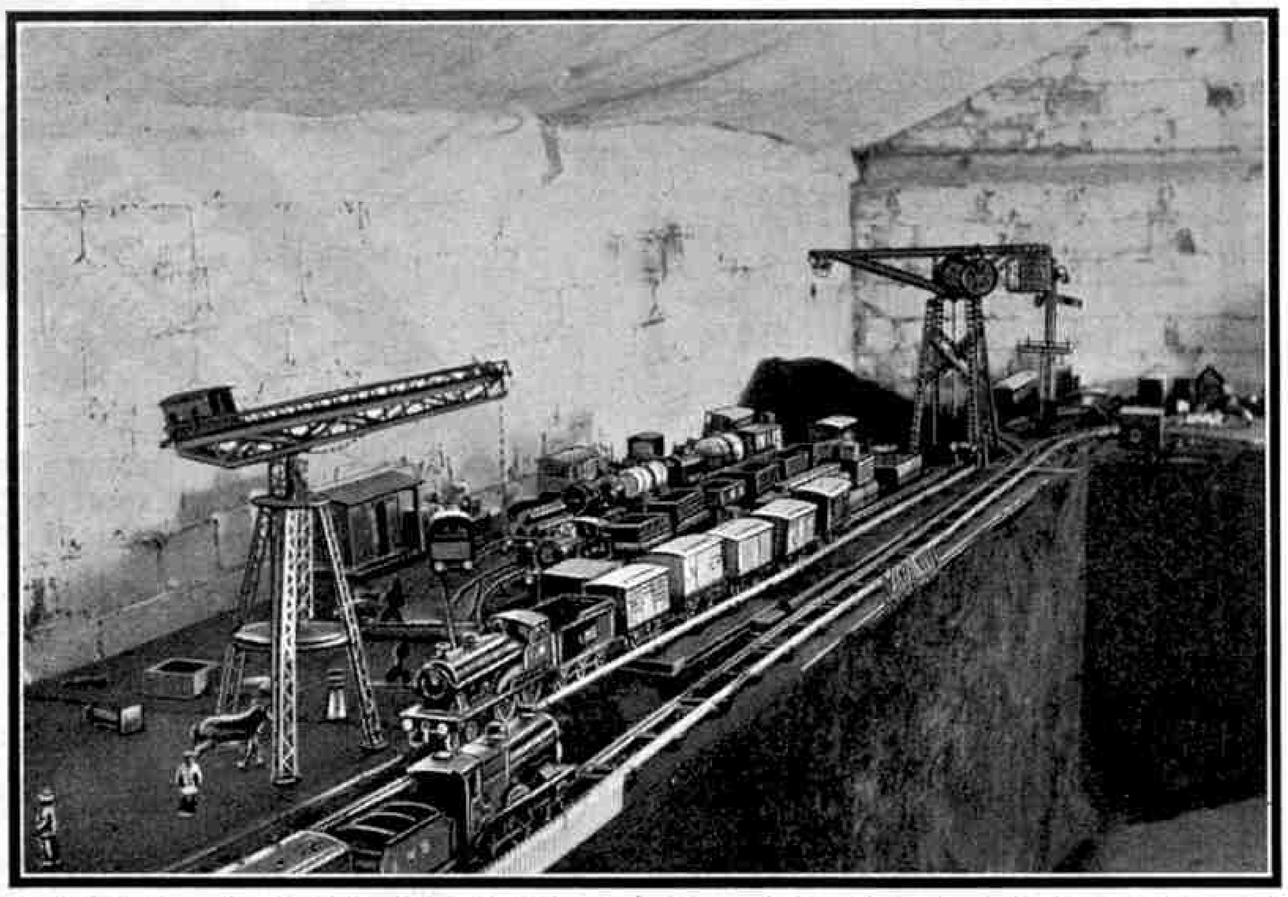
The arrangement for allowing a train that has left the terminus to return, after its journey has been completed, consists of a return loop line CC. running down the centre of the main track, and shaped like an elongated letter "S." Its connections to the main line are such that the return path of a train may lie along it in either direction. To make this point clear let us follow the movements of a train leaving either platform of the terminus as convenient.

After clearing the station premises, two trailing points are negotiated and the main line is reached. Assuming that the loop facing points are set for the straight run, the train proceeds to the passing station B, where it may call if required to do so, or a stop may be made there later in the journey. Rounding the curve after B another set of facing points is encountered, and if these also are arranged for the straight run the train makes a complete circuit of the main line; or as many circuits as required by the working arrangements.

For the return to the terminus the central or return loop facing points are set for the curved road when required. Assuming that the train is waiting at B, the loop points may be set and the train run directly into the terminus, gaining the loop by the points at one end of the system and leaving it by the loop points at the other, before taking the right-hand facing points leading to the terminus. Alternatively it may be sent

on to the loop quite early in the run, and thus be ready to be switched into the terminus whenever required.

On arrival at the terminus a typical cycle of operations would be for the empty coaches to be shunted out of the platform clear of the left-hand points leading to the siding line. The engine then crosses over to the departure side and makes its way to the engine spur, where it waits until required for the next train out. The coaches may be shunted into the siding by another engine, or to the departure platform if immediately required again. Alternatively there may be employed a method that is in use at many actual termini for dealing with empty coaching stock. The line slopes up out of the station, and the vehicles are pushed out by the engine that brought them in. They are then allowed to run into the required line by gravity, under brake control, after the engine has been disposed of. This is an interesting scheme, and is useful in saving engine power, so that it has strong claims for its adoption on a miniature line. Where an incline is not considered possible or advisable the operator's finger may supply the necessary "gravity."



Part of the layout of P. E. Clarke of Whitchurch. The main line shown is single track at this point where it passes a four-road goods yard. Photograph by courtesy of Mr. A. J. Crosse, Whitchurch.

Although the layout as a whole is satisfactory, certain improvements would add greatly to the convenience and entertainment of operating it, and one or two modifications are shown by dotted lines in the diagram. Where tender engines are in use a turntable is practically a necessity, especially if the engines are required to make further trips soon after their arrival. The engine spur has therefore been shown as leading to a turntable, though the exact nature of the arrangements around it will depend largely on the space that is available. Where light engine running is not objected to, and traffic is not very heavy, an engine that has shunted its train out as described previously may be run through the return loop and along the main line, through the passing station B, and so back into the terminus, becoming reversed in the process.

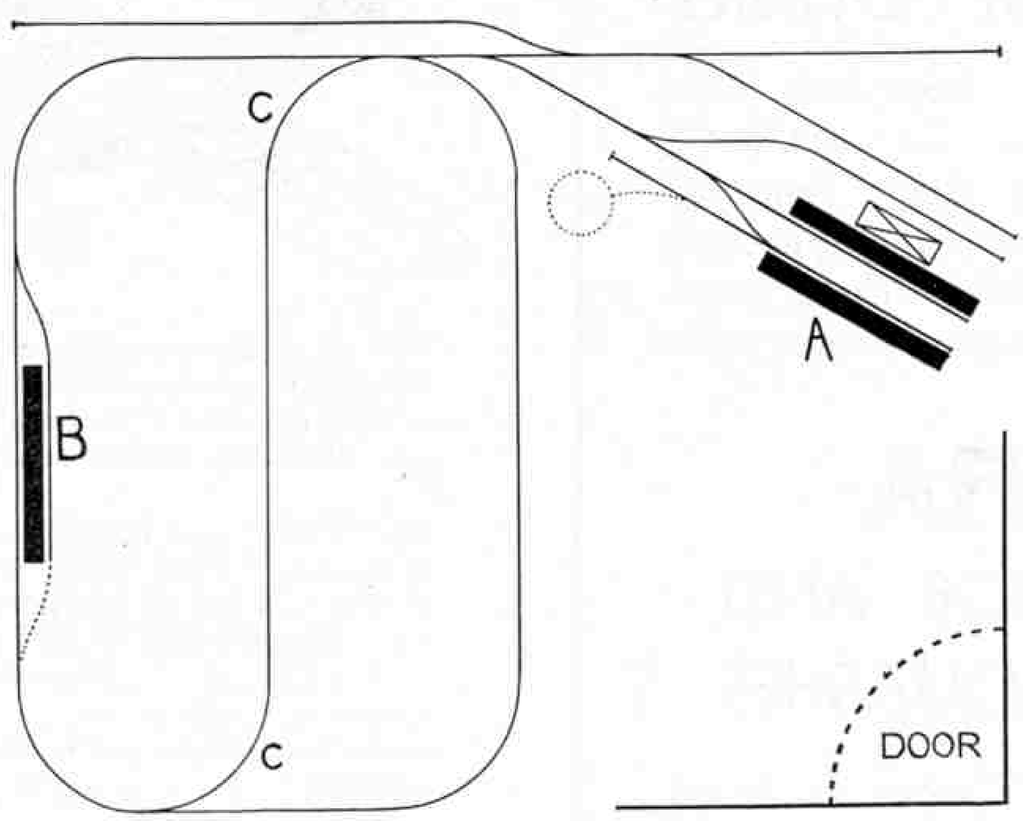


Diagram of the layout of M. Wormald as described in this article.

At the passing station, too, the "dead-end" or terminal road may be extended, as shown by a dotted line in the diagram, in order to form a loop. This will greatly increase its usefulness, and open up fresh possibilities in the matter of train working. Trains may use the two roads in the manner usual for up and down traffic, the loop formation allowing them to be scheduled to pass each other at the station. Such passing loops are often a feature of main lines that are largely single track, such as the Highland Section of the L.M.S.R. The crossing arrangements have to be made very carefully to avoid delay to important long-distance traffic, whether passengers, perishables or freight.

On the layout we are considering at the moment two trains may be arranged to leave the terminus, one shortly after the other, and while one may be kept to the main oval the other may be diverted to the loop and so reversed in direction, arrangements being made for them to cross at the passing station. They may then depart in opposite directions, and while one may run directly into the terminus, the other may be diverted on to the return loop and so follow it in. Alternatively one may wait at the passing station while the other makes one or two more circuits of the main track. There is practically no limit to the different combinations of operations that may be carried out in this direction, the possibility of the trains meeting head-on on the single-line portion of the track being of course carefully guarded against. If the working scheme is developed by degrees, the necessary precautions in different circumstances become practically second nature to the operator, and are taken more or less automatically; whereas there is always a chance of their being overlooked if too much is attempted at the start.

In the space available for the system in question it probably would have been possible to install an additional terminus between the door and the existing station A. This would certainly allow of realistic working, but for one operator the single terminal scheme gives a better chance of dealing with the different trains, as simultaneous attention to both stations would be practically impossible. Again, the return loop then would hardly be required for reversing the direction of the trains, and thus a certain amount of interest would be lost; and the presence of a terminus by the doorway would not be convenient.

On most layouts the extension of the sidings is carried out from time to time as necessitated by the periodical increase in the rolling stock. On the system we are dealing with the existing sidings could be multiplied by laying down additional roads parallel to them.

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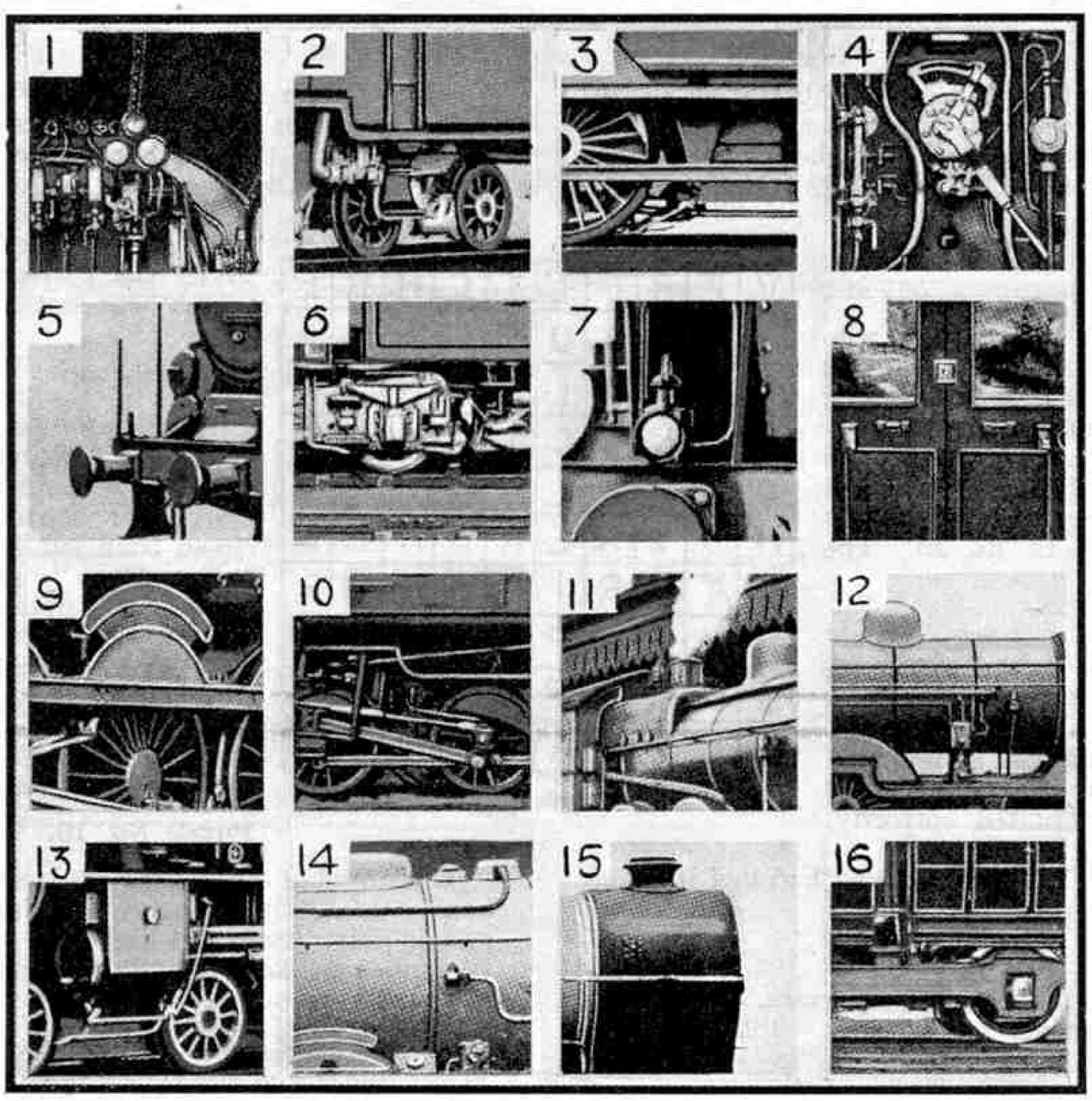
H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

CHRISTMAS PUZZLE CONTEST

The most popular competitions that have appeared on this page have undoubtedly been those in which an essential feature was railway knowledge combined with the use of sharp eyes. This month we announce another Contest of this type that will, we believe, arouse widespread interest among H.R.C. members.

The practice of each of the four railway groups is distinguished by certain characteristic features, such as the copper-capped chimneys of Great Western passenger engines, the roofs with domed ends of L.N.E.R. coaches, and many others. In the panel in the centre of this page are 16 small pictures, each of which illustrates some outstanding feature of a locomotive or item of rolling stock. In each case this feature enables the owning railway company to be determined. Competitors are required to decide which is the outstanding feature of each picture, and from this to state the railway group to which the vehicle belongs.



Competitors should solve as many of the pictures as possible, and then make out their lists and forward them to Headquarters. Those who cannot find the correct solution to every illustration should send in their entries just the same, remembering that many other competitors will be in exactly the same difficulty.

Cash prizes to the value of £1-1-0, 15/–, 10/6 and 5/– respectively will be awarded to the four competitors in each of the two sections, Home and Overseas, who submit the most nearly correct solutions, in order of merit. In the case of a tie for any prize, consideration will be given to the neatness and general style of the entries.

Envelopes containing entries should be marked "H.R.C. Christmas Puzzle Contest" and posted to Meccano Ltd., Binns Road, Old Swan, Liverpool, to arrive not later than 31st December. The closing date for the Overseas Section is 31st March.

It must be remembered that the omission of the H.R.C. number from any entry will cause it to be disqualified. This is an important condition to which members should pay special attention, as its neglect in the past has occasionally caused entries to be discarded that might otherwise have been successful. Members should ensure that their name and full address is clearly written on each sheet of paper submitted, as a number of entries are sent in not bearing any name and address.

Locomotive Drawing Contest

The efficiency of the steam locomotive has been developed to a remarkable degree during the past half century as new ideas have been put into practice, and new designs brought to perfection. The L.N.E.R. locomotive No. 10000 is a good example of the progress that has been made, and possibly it indicates to some extent the trend of future locomotive design. We wonder what a steam locomotive will resemble in another 50 years' time, assuming of course that steam power is still in use on our railways. Will it follow the lines of the L.N.E.R. monster, or will it be some entirely new design undreamt of at the present time?

For our Competition we want competitors to give their version of locomotives of the next era in the form of a drawing. Competitors should take care not to allow their imaginations to run riot. For instance, in suggesting boiler developments they should have reasonable regard for the requirements of the loading gauge. Similarly the number of wheels should not be increased so greatly that it is impossible to round curves of the radius now usual!

The competition will be divided as usual into two sections—Home and Overseas. Prizes of Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the four competitors in each Section who submit drawings showing the best locomotives of futuristic design.

Envelopes containing entries should be clearly marked in the top left-hand corner H.R.C. "*Futuristic Locomotive Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 31st December. The Overseas closing date is 31st March. Competitors should endeavour to send their entries before the published closing dates, for those received after cannot be entertained. The competitor's name, address and H.R.C. membership number must be written on the back of each entry.

COMPETITION RESULTS

HOME

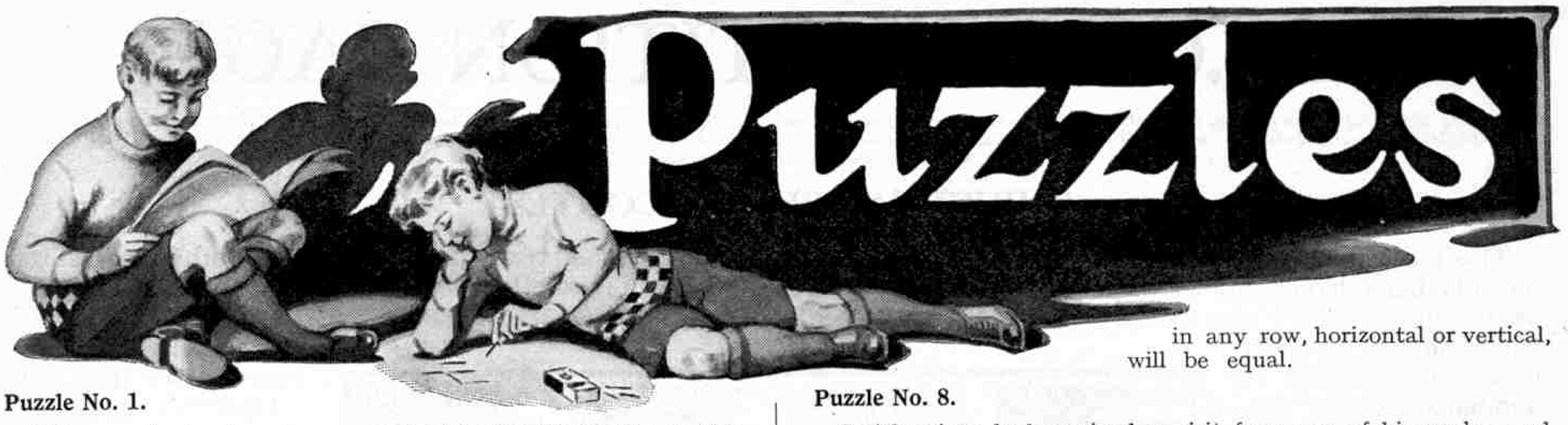
September "Jumbled Accessories Contest."—First: J. E. Garrett (3282), Coulsdon. Second: R. A. S. Musker (13162), Hightown. Third: J. F. Aylar (25864), London. Fourth: B. de B. Nicol (18586), Aberdeen. Consolation Prizes: V. Knill (26118), Thorpe Bay; H. A. T. Aitken (2602), Bridge-of-Weir; D. S. Eburne (21915), Portsmouth; E. G. Veness (29595), London; A. G. Bennett (15716), London; J. R. Sleightholme (17091), York; A. S. Maultby (30561), Lincoln; D. J. Rogers (20769), Kingstown, Co. Dublin; A. P. Turner (29305), Pinner Hill.

September "Essay Contest."—First: C. C. O. Young (24182), Bedford. Second: L. Parish (18054), Coventry. Third: H. E. Jones (14740), London. Fourth: L. L. Luck (1685), Portsmouth. Consolation Prizes: G. Watts (21908), Newmarket; H. Everitt (18738), Norbury; H. J. H. Evans (30397), Birmingham; P. Chandler (1592), Weston-super-Mare.

September "Holiday Drawing Contest."—First: R. C. Storrar (8625), Letham Ladybank. Second: J. A. Saunt (2264), Coventry. Third: L. Martin (6922), Leicester. Fourth: H. Everitt (18738), London.

OVERSEAS

June "Loco Feature Contest."—First: R. V. Turner (10034), Australia. Second: J. H. Neville (23636), Australia. Third: R. A. Wragg (7913), India. Fourth: A. Abdulrahim (10438), India.



Puzzle No. 1.

Fifteen motoring terms are contained in the illustration to this puzzle. In order to discover them it is necessary to start at a certain square and to follow the king's move at chess, which is one square at a time in any direction. The first word begins in the second square along in the third line from the top. Every letter in the square is used once.

Puzzle No. 2.

Farmer Brown was annoyed with his son, who was home on holiday from school. The son was continually telling his father that he was becoming rusty hidden away in the country. Eventually the farmer found a way to baffle his son. He wrote four letters on a piece of paper and asked his son if he could make any meaning out of them. The son was unable to do so. The four letters were :

CC
SI

What did they mean ?

Puzzle No. 3.

There are not many words that can be repeated eleven times in succession to make sense. If the following sentence is punctuated correctly, however, it is possible to read it :

Brown where Smith had had had

sword. This sounded very easy, but Billy was told that not only had he to cut it into pieces, but he had to cut it into the maximum number of parts possible. On the illustration for this puzzle draw lines showing the manner in which the moon should be cut to meet this condition.

Puzzle No. 14.

Tommy had not been paying attention during the English lesson and was making up for it after school.

"Now," said his teacher, "I will let you go when you can tell me which Shakespearean character appears to have been the biggest poultry dealer in his district!"

Fortunately Tommy possesses a Shakespearean concordance and he was very soon playing football in the yard.

Who was the gentleman in question?

Puzzle No. 15.

In their order, write down single words to fit the following definitions: Toss; leave one country in order to settle in another; fight or state of conflict; room for provisions.

When these words have been written in a line in the order given it will be seen that they contain four concealed words with the following meanings:—

A natural hole in the ground; reduce to small particles by rubbing on a rough surface; of common occurrence; and breathe laboriously. When these words have been struck out, what important science is indicated by the remaining letters?

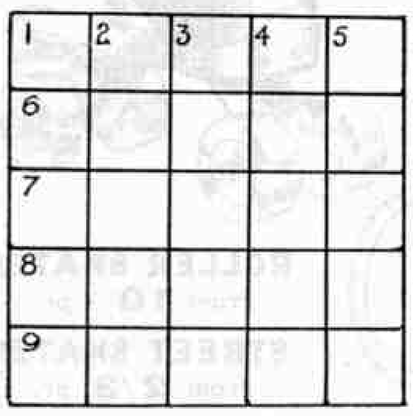
Puzzle No. 16.

This puzzle is a crossword puzzle in which there are none of the customary blank squares. The clues are as follows:—

Down.	Across.
1. With no sound.	1. Cues.
2. In a state of rest.	6. Employ for a purpose.
3. Unassuming.	7. Eyes.
4. Silent.	8. Comfort.
5. Unobtrusive.	9. Annoying.

Puzzle No. 17. *(Contributed by Maxwell Adams, London, S.E.21.)*

My first is in match but not in fire,
My second in sleep and also in tire;
My third is in Christmas but not in laugh,
My fourth is in cow and also in calf;
My fifth is in hand but not in but,
My sixth in almond and also in nut;
My seventh is in tower but not in steeple,
My whole brings joy to many people.



Puzzle No. 16.

Puzzle No. 18.

Cut a cross out of cardboard similar in shape to the one shown at the top of this page. It need not necessarily be of the same size, but it should be noted that it really consists of five squares, each of the arms being equal in size. When this cross has been made it should be cut into four pieces as indicated by the dotted lines. With these four pieces of cardboard make another cross of similar shape.

Puzzle No. 19.

"Well, Williams," said the manager, "I will start you at a salary of £50 per year."

"Yes, sir," said the new office boy, "but what about rises?"

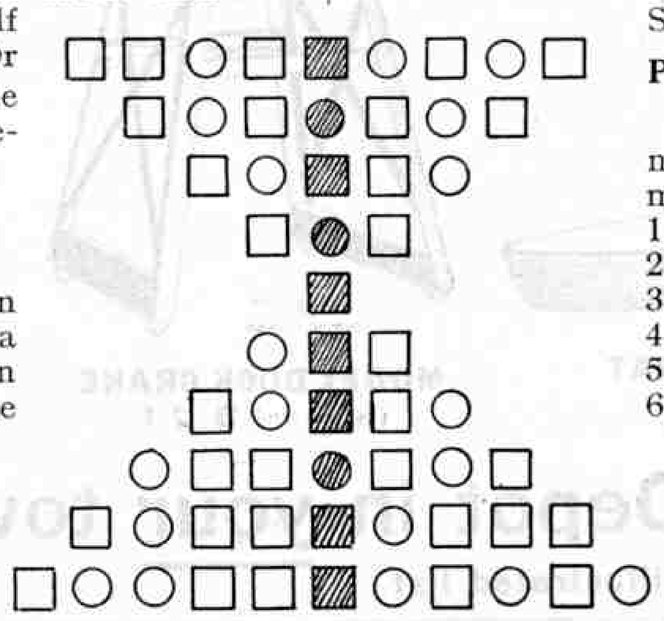
"I will give you an increase of £5 every half year," said the manager; then he continued, "Or you can have £20 a year if you prefer it." The office boy immediately choose the latter arrangement.

Which would you have choosen, and why?

Puzzle No. 20.

A young city man was planning a short holiday in the country and one day he hired a horse from a man who was also the village blacksmith. On asking for his bill at the end of the day he received the following cryptic message:

OSFORADA ...	...	9s. 6d.
AFORTHOS ...	...	2s. 6d.
ASSUINHIM ...	...	3s. 6d.
ATEKINHIMUMAGEN		6d.
		16s. 0d.

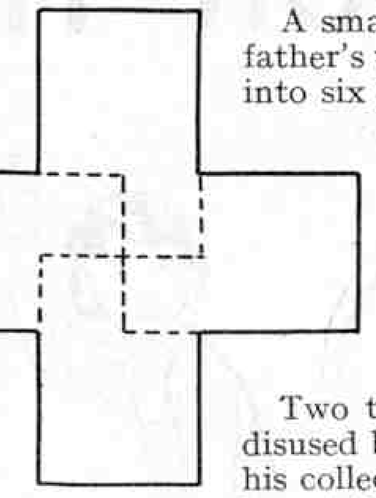

Puzzle No. 25.

Puzzle No. 21.

What is it that men love more than life,
Fear more than death or mortal strife,
The poor man has, the rich man wants,
The miser spends, the spendthrift saves,
And all men carry to their graves?

Puzzle No. 22.

A small boy was one day endeavouring to find out how his father's watch worked and had the misfortune to break the face into six pieces. He anticipated trouble when his father came home, but discovered that the pieces had broken in such a manner that the hours in each of them added up to the same number. His father was so intrigued by this that he forgot to punish his son, as he had at first intended. Show on the illustration to this puzzle the sections into which the face broke.


Puzzle No. 18.

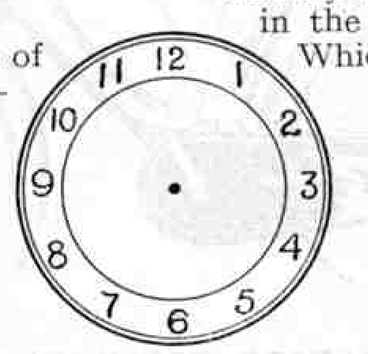
Puzzle No. 23.

Two tramps were spending a Saturday night together in a disused barn, and one of them, known as Herbert, was counting his collection of cigarette ends. From long experience he had learnt that one whole cigarette could be made from seven ends, and he was very pleased to discover that the total he had collected amounted to 49.

"That means one cigarette each day next week," he remarked to his companion.

"Nonsense," said the other tramp, "you can smoke two on Sunday and still have one cigarette for each of the other days in the week."

Which of the tramps was correct?



Puzzle No. 22.

Puzzle No. 24.

Fill in the figure accompanying this illustration from the following clues, putting only vowels in the circles.

(1) State of alarm. (2) Breezy. (3) A pudding detested by small boys. (4) Expression of dismay. (5) What things are as extinct as. (6) Air. (7) Four-fifths of Yeats.

When these clues have been filled in properly the first and third horizontal lines will give the name of a famous figure in electrical research, and a country famed for its ideal life.

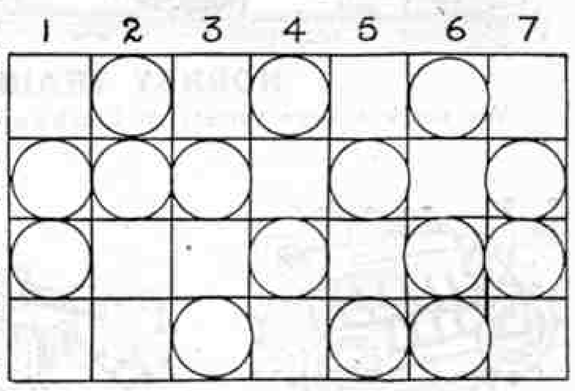
Puzzle No. 25.

Fill in the squares and circles in the figure at the bottom of this page, putting consonants in the squares and vowels in the circles. When this has been done the letters in the shaded vertical line form the name of a bombing aeroplane. The clues, from the first line downward, are as follows:

What a mountaineer does when he wishes to descend a snow slope rapidly.

What most people think their own arguments are.

A sparking plug.
Through.
Beginning of S.O.S.
Possessive adjective.
Gorse.
Transfixes.
A light trinket.
State between North Dakota and Nebraska.



Puzzle No. 24.

Puzzle No. 26.

From each of the following jumbled words the names of an aeroplane and its makers may be made.

1. OSDBOLRUNNNLTATPDAUDSIEA
2. DXOOHTLHDMEVIALNFA
3. TCRSWOMPFIE
4. VVAIKSEIRCRGNII
5. AWTGHSNTATAALITMNTHORRRAWD
6. ABBBBCDEIKLLNRRUU.
7. SPSPNERHOTUTNOMAMAIREU
8. KORSTHENT
9. RVVAINAAO
10. AEHIKMORTTTW
11. AACEIIKRRSSTVV
12. AAEHLORSTTTV.
13. YPNNNLLIHHGEEDBAAAA

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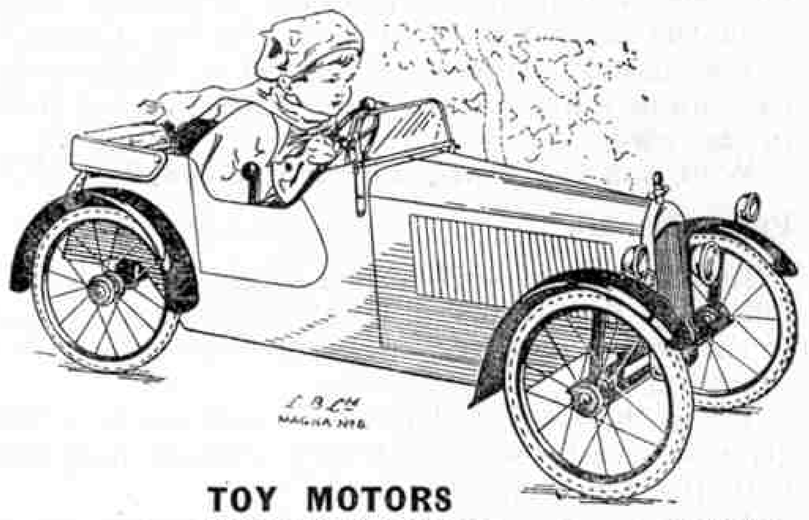

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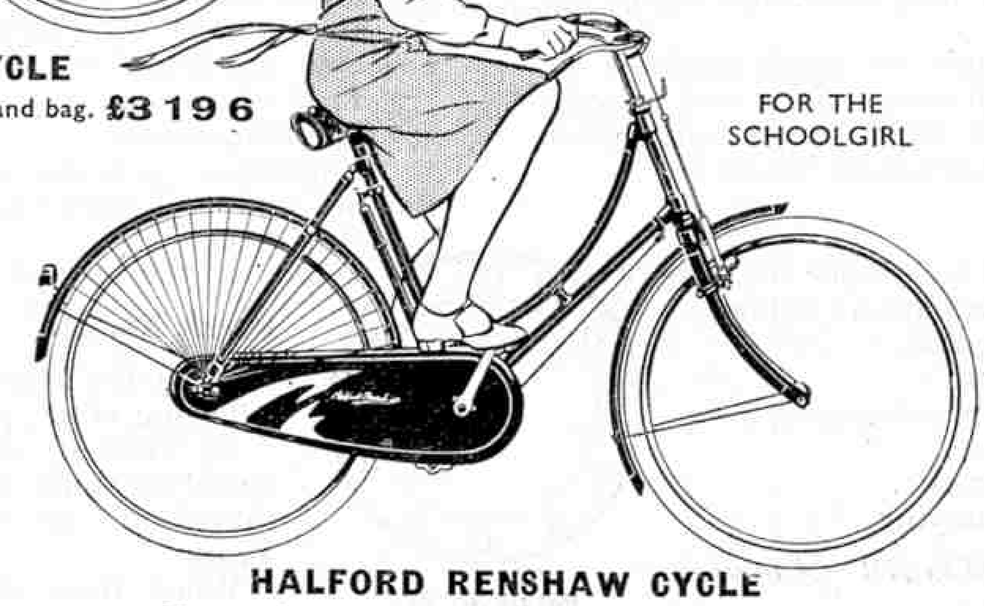

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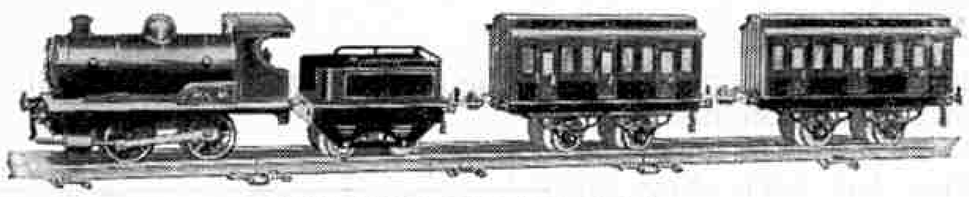

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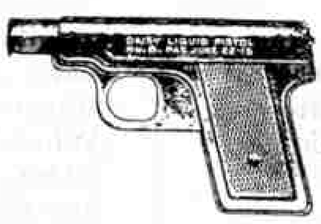

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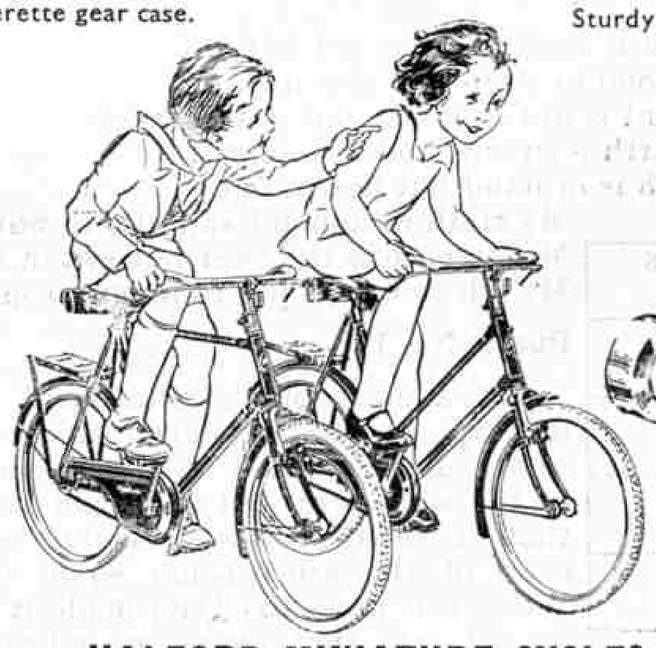
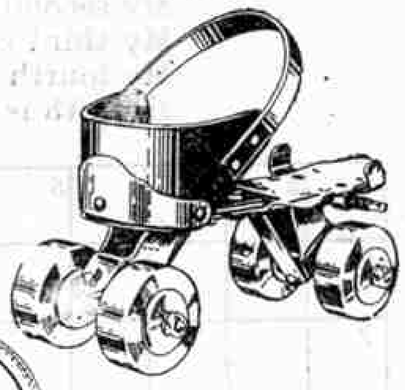
1/9





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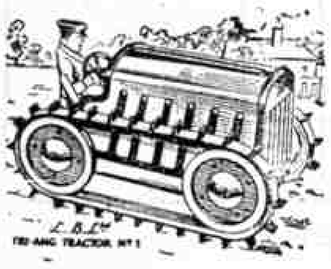

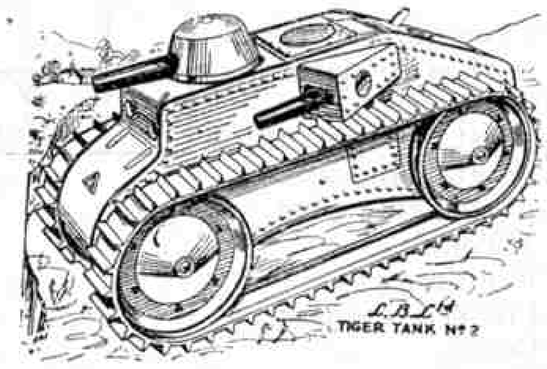

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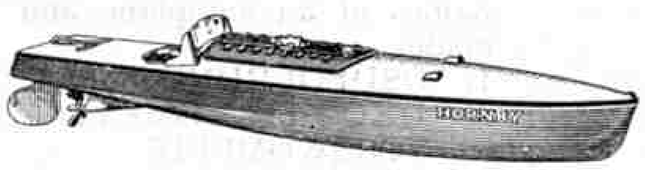
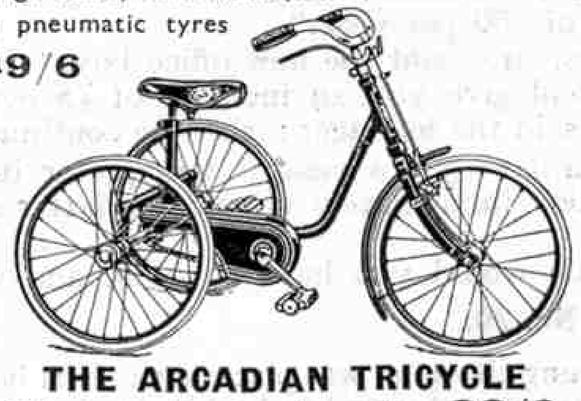


HORNBY SPEED BOAT
12/6

MODEL DOCK CRANE
(as shewn) **3/11**



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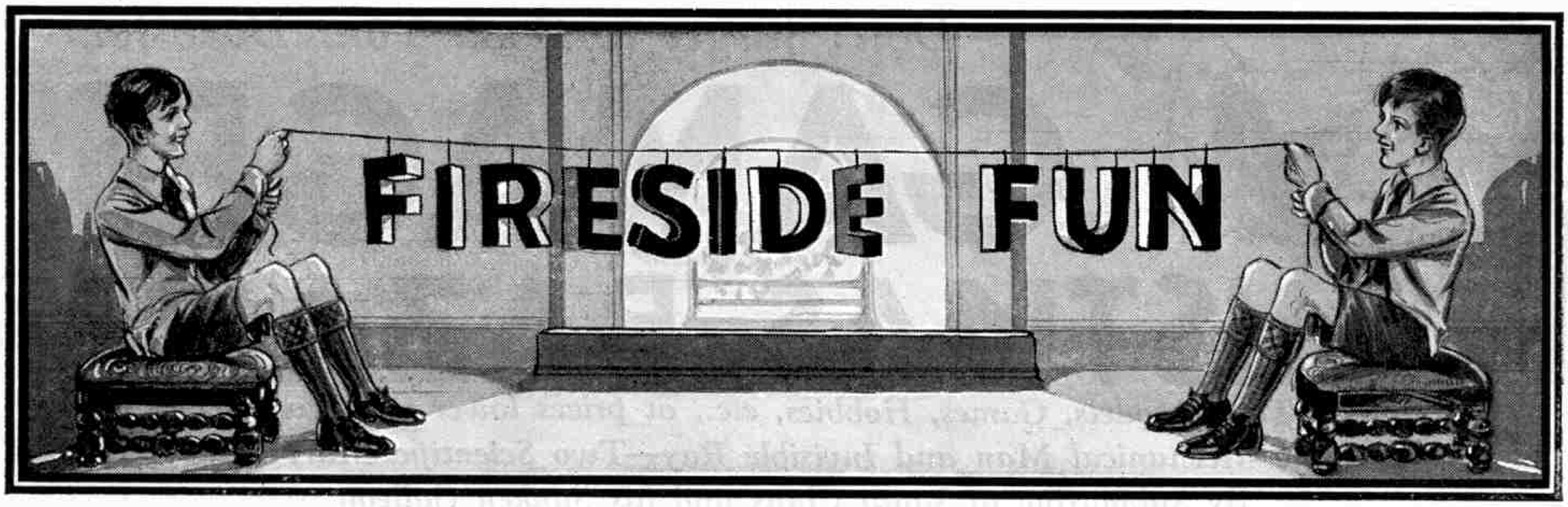


SCHOOLBOY HOWLERS

Gladiators are iron things which give out heat.
Herrings travel in the sea in shawls.
The highest mountain in Europe is Blanc Mange.
The gulf stream is composed of warm currants.
Cereals are stories which last several weeks.
A centimetre is an insect with a hundred legs.
A vacuum is the residence of a Pope.
Barbarians are things used to make bicycles run smoothly.
Mandolines are high Chinese officials.
Ali Baba means that you were somewhere else when you committed the crime.

* * * *

Mistress of boarding house (reprovingly): "Is this your cup of tea on the chair, Mr. Williams? It is a very peculiar place to put it."

Mr. Williams: "Oh, not at all, it was so weak that I thought it needed a rest."

* * * *

Country Mary was talking to her mistress. "'Tis going to rain to-day, mum. Mrs. Roger's wireless said so last night. But there, perhaps it don't know, it's only a cheap one!"

* * *

"This is a very old church, isn't it?" asked the lady visitor.

"Yes," replied the young girl. "It was here when I came."

* * *

A young woman who wanted a pet dog went to a dealer.

"I want one of those dogs about so high, and about so long," she said. "A sort of greyhound, but it isn't quite because its tail is shorter and its head is bigger. Also you see the legs aren't so long and the body is thinner. Do you keep that sort of dog?"

"No, madam, I don't," replied the dealer, "I drowns 'em."

* * *

"Good heavens! Have you had an accident?"

"No, Bill said he could climb up a ladder carrying me on his back, and I said he couldn't."

"But how did you get hurt?"

"I was right!"

* * *

Mother: "Now remember, Henry, not to leave your homework so late again. You should never put off till to-morrow what you can do to-day."

"In that case, mother, can I start on my birthday cake to-night?"

* * *

Master: "Now then, Jenkins, what countries are on the other side of the Atlantic?"

Jenkins (hedging): "Er—it all depends on which side you're standing, sir."

* * * *

Patient "Do you think, doctor, that there is any danger of the operation proving fatal?"

Doctor: "Really, Mr. Brown, considering that we are experimenting on you free of charge, your idle curiosity is decidedly bad form."

* * * *

It was a pouring wet Saturday.

"Why does it rain, Mother?" asked Henry with his nose pressed to the window.

"To make things grow," replied Mother.

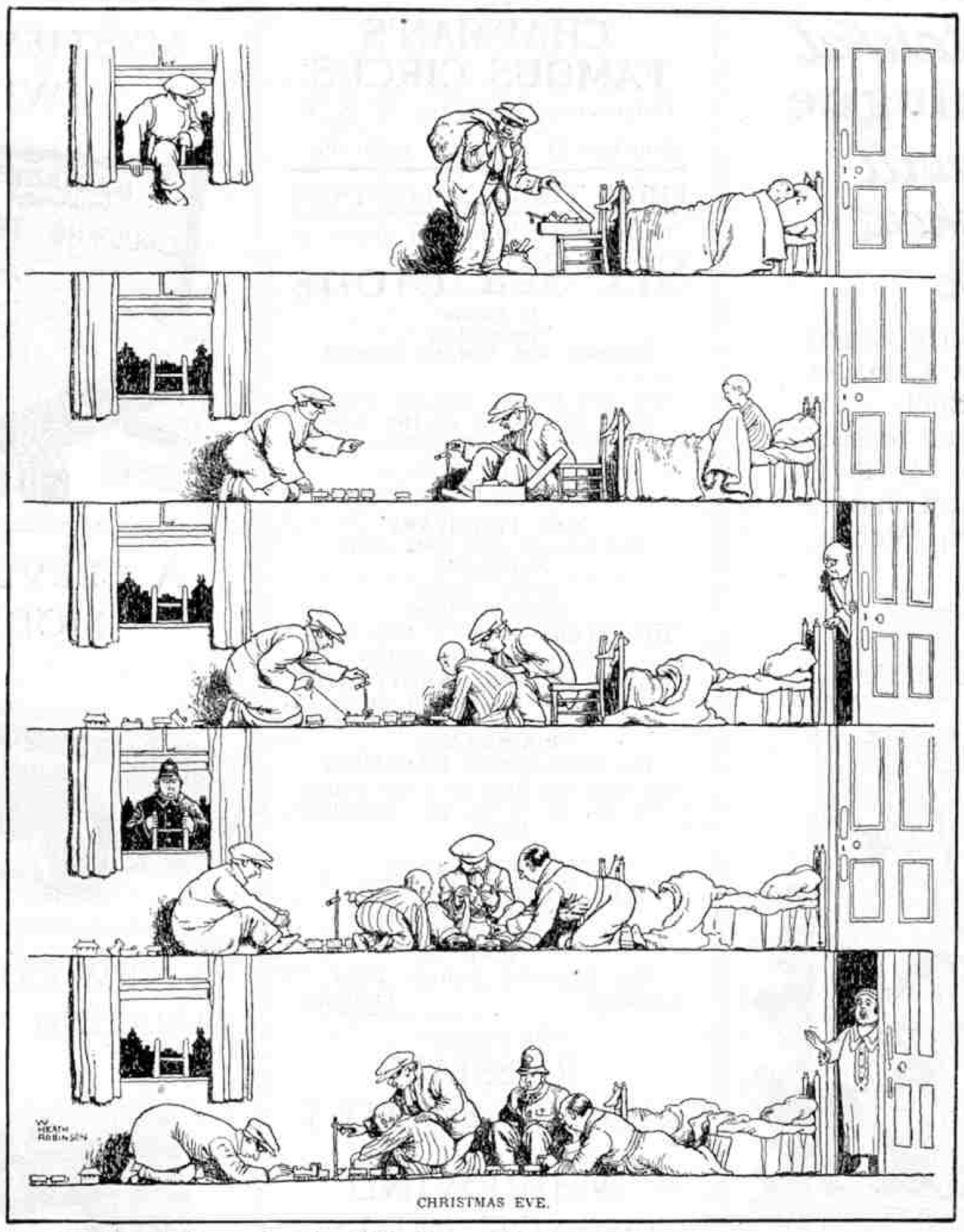
Henry thought for a time.

"Then why does it rain on the pavements?" he demanded.

A MATTER OF TIME

"Do you know that my grandfather is nearly sixty years old?"

"That's nothing. If mine lives long enough he'll be a hundred and sixty."



CHRISTMAS EVE.

Reproduced, by permission, from "The Humorist."

A big and powerful looking cyclist stopped at the cross roads in a village, and going up to a local youth standing by said: "C-can you t-t-tell m-me the r-road to C-C-C-Coventry?"

The boy flushed and looked uncomfortable, but did not reply. Twice the stutterer asked his question, but the boy still remained silent, and eventually a man who had watched them directed the cyclist.

After the cyclist had gone the man turned to the boy and asked him why he did not answer the question.

"W-What!" replied the boy," and g-get a p-p-punch on the n-n-nose!"

* * * *

Teacher: "Find the lowest common denominator—"

Willie: "Goodness, is that thing lost again?"

PUTTING IT OFF

The court jester was in disgrace. "Thou shalt die," thundered his master, "and thou shalt choose the manner of thy death."

"Then, your majesty," replied the fool, "I choose to die of old age."

* * *

A negro cook went into a bank with a cheque from her employer. As she could not write, she always endorsed her cheques with a cross. On this occasion she made a circle on the back of the cheque.

"Why don't you make a cross as usual?" demanded the clerk.

"Ah done got married yesterday, boss," came the reply, "and I'se changed ma name."

* * *

"Have you ever met my sister Louisa?"

"Yes. She's rather stout, isn't she?"

"I have another at home—Lena."

* * *

"When is the best time to catch soft water?"

"When it's raining hard."

* * *

"You know this is the fourth time I have had to ask you to return that money I lent you."

"That's nothing. I had to ask you at least a dozen times before you would lend it to me."

* * *

"How much will you charge to take out this front tooth?"

"Five shillings."

"Oh, well, it doesn't matter. I'll pick a quarrel on the way home."

* * *

"I say, Bill, what do you think of Richards?"

"I can't stand him. He's one of those people who pat you on the back before your face, and hit you in the eye behind your back."

* * *

Diner: "Waiter, did you say that this was a cabinet pudding?"

Waiter: "Certainly, sir."

Diner: "I thought so. Here's a piece of the door."

* * *

"Did you hear about Smith?"

"No."

"He had to go to court the other day. He refused to stop talking when he got into the dock, but the magistrate managed to get in a sentence."

* * *

"Is that the second gong?" the boarding house guest asked one of the maids.

"No," replied the maid. "That is the second ringing of the first gong; we have only one gong here."

* * * *

"That woman lives in a very small flat."

"Do you know her?"

"No."

"Then how can you tell?"

"Her dog wags its tail up and down instead of sideways."

* * * *

In mid ocean a girl who had been watching a miserable-looking man said to the woman beside her: "Your husband is a very poor sailor, is he not?"

"Certainly not," replied the woman "he's a rich farmer.'

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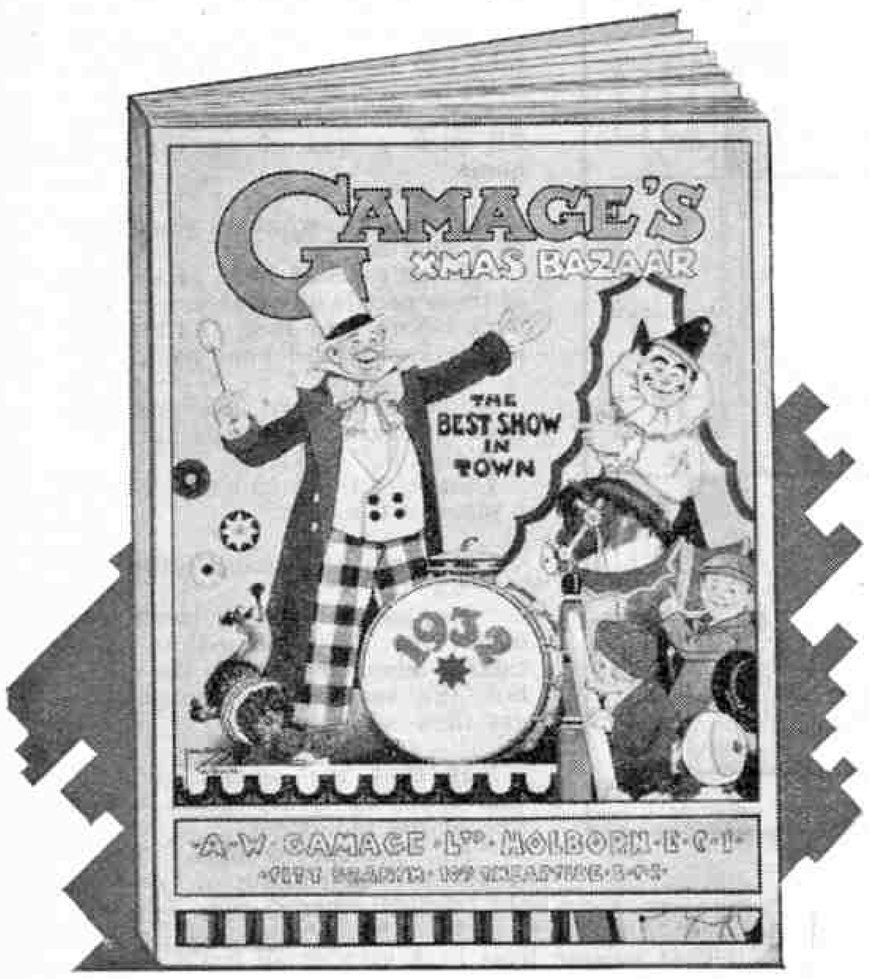

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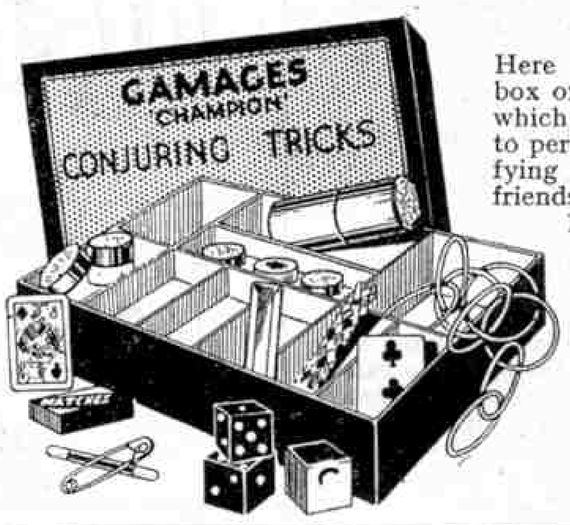

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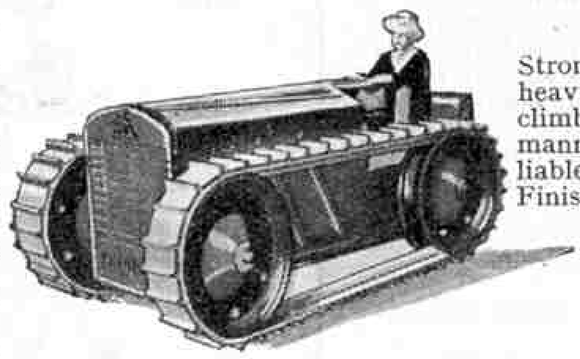

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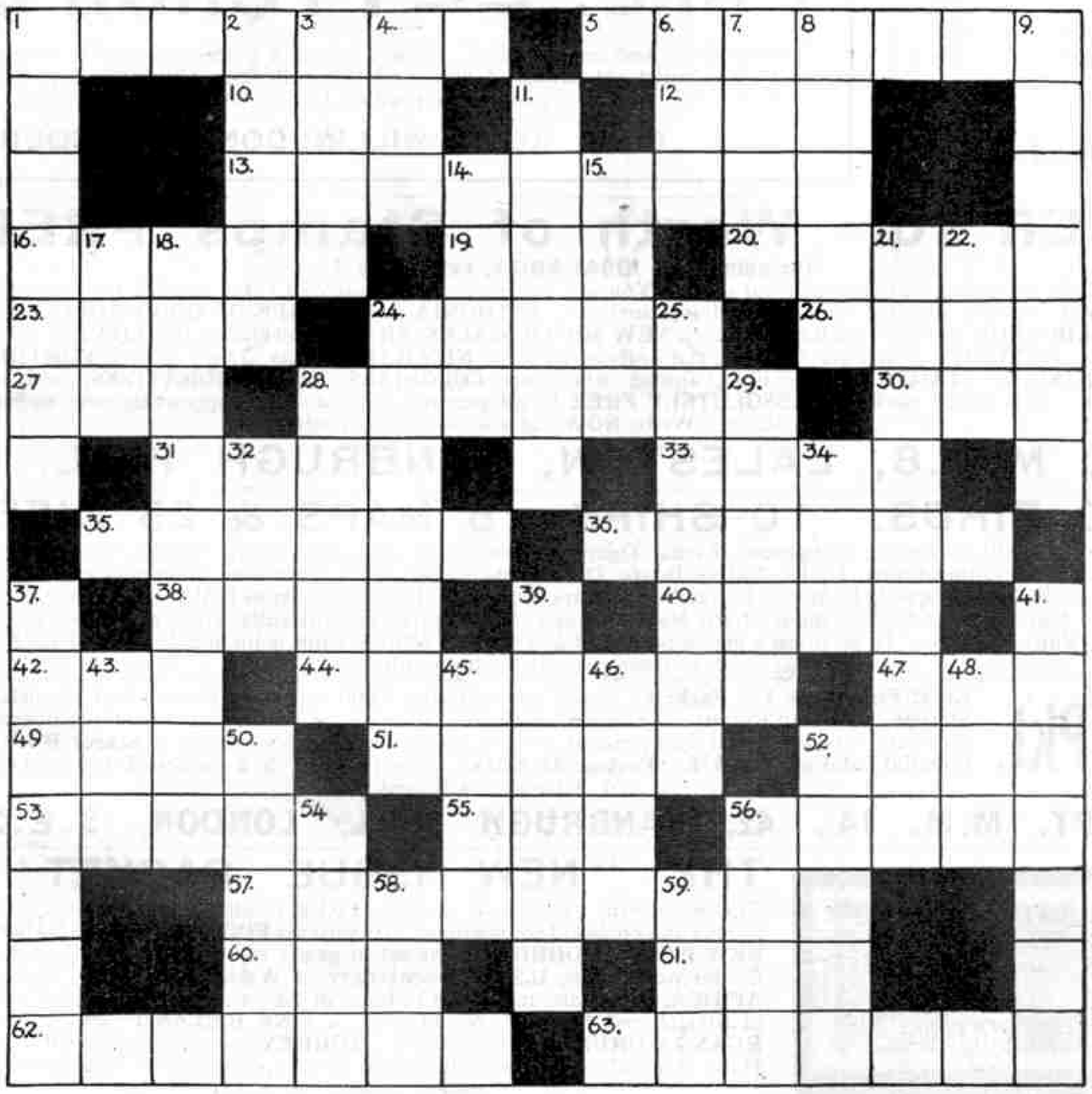
Competition Page

DECEMBER CROSSWORD PUZZLE



CLUES DOWN

1. Agree
2. Falls
3. Colour
4. Suitable
6. Stupid
7. Arranges
8. Examines
9. Held
11. Rough surfaced instrument
14. Or
15. Beautiful garden
17. Grief
18. Engrossed
21. Unchanged
22. Damage
24. Military Stores
25. Revokes
28. Guide
29. Delay
32. Female sheep
34. Lion
37. Moaned
39. Resting
41. Fix
43. Increase
45. Scorch
46. 13th and 15th days
48. Employ
50. Medicinal plant
52. Beat
54. Chamber
56. Gone away
58. Practice
59. Headgear

CLUES ACROSS

1. Windlass
5. Moulded
10. Part of Mouth
12. Look
13. Concerns
16. Cleaned
19. Male person
20. Remaining part
23. Ages
24. Flower
26. Break
27. Fresh
28. Arranged
30. Part of verb "To be"
31. Coin
33. Cloak
35. Cried
36. Lease again
38. Labourer
40. Plant
42. Knock
44. Neatly
47. Regret
49. Songs
51. Conducts
52. Supreme
53. Snake
55. Eaten
56. One who wades
57. Feeds
60. Neither
61. Insect
62. Falsely charged
63. Completely

Entries to our recent crossword puzzle competitions show unmistakably that these are among the most popular of our readers' winter evening pastimes. Indeed, we have had many requests for more of these puzzles to be published.

The puzzle we set this month follows the lines of all the previous ones in that it is set for amusement only, and every effort has been made to avoid unfair traps in the form of alternative solutions. Where alternatives are possible, a definite indication as to the intended word is given in the clue itself. The clues will be found perfectly straightforward, and every word will be found in Chambers or any other good dictionary. Beyond this it is unnecessary to make any explanation of the requirements of the competition, for the rules governing the solution of crossword puzzles are well known.

Prizes of Meccano or Hornby Train goods (to be chosen by the winners) to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the first four correct solutions, in the order in which they are opened on the morning following the closing date. In addition there will be a number of consolation prizes, and, in awarding these, neatness and style of presentation will be taken into consideration. These prizes will be duplicated for Overseas competitors.

Entries should be addressed "December Crossword Puzzle, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must be sent to reach this office not later than 31st December. Overseas closing date, 31st March.

Competitors who wish to preserve their "*M.M.*'s" intact need not cut out the crossword illustration. It will be in order to make a copy of the square and fill that in.

Feature Voting Contest

Frankly expressed opinions are always interesting, and often very helpful. We like to have our readers' views on the magazine, and to give everyone an opportunity of expressing an opinion briefly on a wide range of topics, we offer prizes this month in a simple voting contest.

The following list includes all our important regular features:—Air News; Books to Read; Competition Page; Engineering News; Famous Inventions; Fireside Fun; From Our Readers; Gramophone News; H.R.C. "In Reply" Page; Model-Building Contest Results; New Meccano Models; Of General Interest; Our Wonderful World; Outdoor World; Photography; Railway News; Stamp Collecting; Suggestions Section; What Shall I Be?; With the Model-Builders.

Readers are asked to indicate on a post card the feature they like best of all, and then, in a separate list, to select the 12 most popular features in the order of popularity that they believe will be indicated by the massed votes of all the competitors. It is not necessary for a competitor to head this list with his own favourite feature, unless he considers that it will prove the general favourite also.

Prizes of Meccano or Hornby Train products—to be chosen by the winners—to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the four entries that most nearly forecast the result of the voting.

Entries should be addressed "Feature Voting Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and sent to reach this office not later than 31st December. Overseas closing date, 31st March.

No competitor may submit more than one entry.

COMPETITION RESULTS

HOME

Adventure Voting. 1. S. Reid (Aberdeen); 2. G. Ward (Leeds); 3. M. L. Finch (Beckenham); 4. H. Parker (Manchester). Consolation Prizes: B. C. Boyle (Gilford, Co. Down); H. Day (Doncaster); W. Hunt (Plumstead, S.E.18); B. W. Kirkland (Leicester); T. S. Lansley (Tottenham, N.17); F. Newton (Winsham); S. H. Robinson (Londonderry); C. Ryman (Radcliffe-on-Trent); F. C. H. Skilton (Sedlescombe); R. W. Soden (Diss); M. A. C. Wheeler (Amersham-on-the-Hill).

Doublets. 1. J. Hiatt (Hampden Park); 2. W. L. Maclean (Stornoway); 3. A. L. Beattie (Sydenham, S.E.26); 4. J. A. Cabot (Wallasey). Consolation Prizes: E. Day (London, S.W.7); R. Flood (Staveley); A. W. Marshall (Cromer); A. Robertson (Orkney); K. H. Sutton (Birmingham); F. Spiegelhalter (Barnstaple).

OVERSEAS

June Crossword Puzzle. 1. W. L. Barry (St. Albans, N.Z.); 2. E. Harper (Cambridge, C.P., S.A.); 3. A. McMillan (North Vancouver); 4. S. F. Hunt (Milan). Consolation Prizes: R. B. Anderson (Burma); J. Lyons (Penang, S.S.); MacL. Morgan (Cremorne, N.S.W.); A. Rolfe-Smith (Whangarei, N.Z.); J. W. W. Wilkinson (Toronto, Ont.); F. W. Wilson (Malta).

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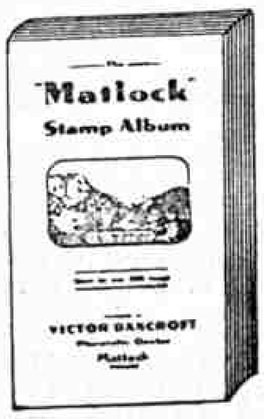

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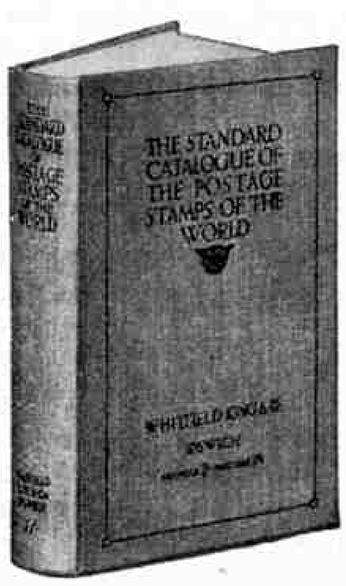

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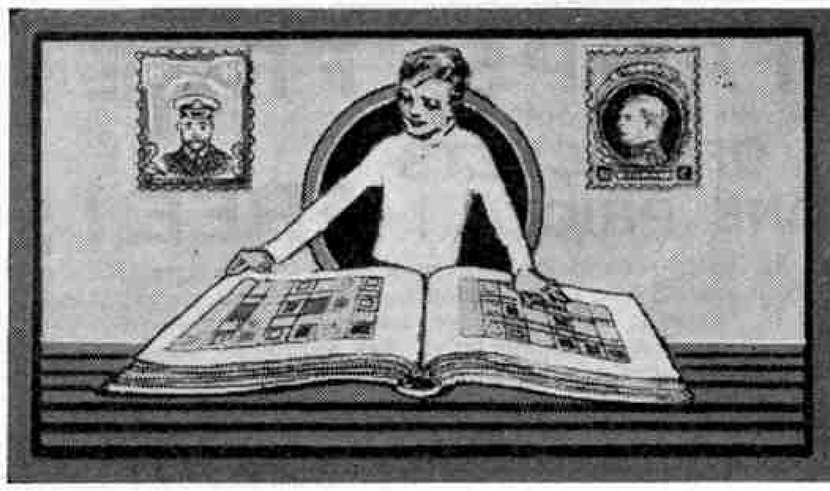

Stamp Collecting

A RAILWAY STAMP COLLECTION

THE railway enthusiast who is also a stamp collector can find much to link his two hobbies in a collection of stamps bearing railway designs. The quantity of material to be collected is not very extensive, and therefore the formation and subsequent maintenance of a complete collection would not prove an expensive matter.

The honour of having issued the first railway stamp falls to New Brunswick, one of the eastern provinces of Canada. The 1c. value issued on 15th May, 1860, depicts a locomotive with a leading four-wheeled bogie and four driving wheels, the classification thus being 4–4–0. The chimney is fitted with a spark arrester of almost amazing size, and there appears to be a high railing along the foot-plate gangway so that the driver may take a stroll around his locomotive without fear of falling off!

The American continent definitely leads the way in the matter of railway stamp designs, for the second such design was issued by the U.S.A. in April, 1869. This was on the 3c. value of the 1869 issue designed to illustrate American history and the mail transport system in use. The locomotive was very similar in appearance to the New Brunswick engine. It was a 4–4–0 equipped with a spark arrester, head light and cow-catcher.

For illustrations of U.S. locomotives we turn to the 1901 and 1912 issues. The 2c. value from the series commemorating the Pan-American Exhibition at Buffalo shows an express train of four Pullman cars hauled by one of the then up-to-date 4–4–0 express passenger locomotives. The 5c. value of the 1912 parcel post issue provides the second of the two illustrations, and shows a mail train approaching a wayside mail delivery apparatus on which a "pouch" of mail is hanging ready to be picked up. This is the finest illustration in our collection, and it is unfortunate that the type of the locomotive cannot be identified definitely. The leading wheels apparently are of the same size as the "drivers" and as the connecting rod is not clearly drawn we are left in doubt as to whether the wheel arrangement is 4–4–2 or 2–6–2.

The designs of the 1912 parcel post stamps were devoted to an exposition of the United States mail delivery system, and they included one other fine railway design. This was the 3c. value showing a postal clerk leaning out of the doorway of a mail train in the act of hanging a sack of mail in position on the arm of the mail delivery apparatus, in readiness for transfer at an approaching wayside station.

Among South America's railway stamps, the 5c. of Uruguay's 1895 issue will take pride of place in a British boy's eyes, for the engine illustrated on this stamp is none other than one of the famous Stirling "single wheelers" that were designed for use in Britain on the old Great Northern Railway.

As our illustration shows, the outstanding feature of the engine, apart from the general grace of its design, is the huge single driving wheel. Stirling's first "single-wheelers" had driving wheels 7 ft. 1 in. in diameter. Subsequently the size was increased still further, and when the new direct line from Doncaster to York via Shaftholme was opened in 1870, Stirling introduced the first of the famous "eight footers." These were so successful that for over 25 years they hauled all express passenger traffic over the Great Northern route and played a very prominent part in the "race to Scotland" that took place in 1888 and 1895.

The first of Stirling's "eight footers" is housed to-day in the railway museum at York, where it has remained since it was taken in 1925 to make a final public appearance under steam at the Railway Centenary celebrations at Darlington. Uruguay's first railway was opened on 1st January, 1869, so that the country had had more than 26 years of railway operation at the time this stamp was featured.

In 1895 Mexico issued a series showing the various methods by which her mails were transported. The peso values show a mail train, the engine with a very low boiler compared with the gauge of the running track, and provided with a spark arrester, a headlamp and a cow-catcher. The first railway in Mexico was a line 2½ miles in length between Mexico City and Guadalupe, this being finished in 1854. Other small lines were built shortly afterwards, but it was not until 1878 that the longer lines were begun.

Salvador followed Mexico in 1896 when it issued a new series of stamps, the 3 centavos showing a 4–4–0 locomotive with cow-catcher, headlamp and tall smoke stack. In 1898 Honduras issued a stamp showing a view of a train. The locomotive on this is also provided with spark arrester, headlamp and cow-catcher, but little can be made of the design as the stamp was lithographed and has not reproduced at all well.

Ecuador's first railway stamp was issued in June, 1908, to celebrate the 25th anniversary of the opening of the railway from Guayaquil to Quito. This stamp, incidentally, is one of the few railway successes that may be credited to South American stamp designers. The beautiful lines of the engine have been most accurately portrayed. Indeed, until the appearance of the 5c. U.S.A. stamp in 1912, Ecuador's effort was quite the most striking railway stamp in existence. The excellence of the design renders detailed description of the engine almost unnecessary, but to remove any doubt that may exist it is worth mentioning that the wheel arrangement is 4–4–0, while in addition to the usual cow-catcher and the searchlight mounted before the chimney, the engine carries a bell located between the steam domes.

This commemorative issue included seven other stamps, six bearing portraits of the promoters and first engineers of the railway, while the highest value, 1 sucre, showed Mount Chimborazo over which part of the line runs.

Before we leave the railways of the American continent, Newfoundland's publicity issue of 1928 demands attention, for its 5c. denomination includes a splendid picture of an express train roaring its way across the island. The size is somewhat too small to make it possible to identify the type of locomotive from the stamp itself, but it may safely be taken to be one of the "Pacific" (4–6–2) engines customarily used on the cross-country express service between St. Johns and Port-aux-Basques, a 547-

(*Continued on page 989*)

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from which you may select any 100 for **3/–.** This selection is **not** made up of the thousand commonest stamps, but contains specimens priced by Stanley Gibbons up to 1/– each. For 3/– you have the opportunity of choosing 100 stamps of the catalogue value of 20/– or more.
H. HARDY,
39, Rosebery Gardens, Hornsey, London, N.8.

Stamp Collecting—(*Continued from page 987*)

mile run that is performed thrice weekly in each direction. The run is carried out in four divisions of approximately equal length, a change of engines being made in each division.

During the summer season when traffic is heaviest, a typical train consists of two baggage and mail coaches, one dining car, two sleeping cars and one first and one second class day coach. The style of the dining and sleeping cars follows closely the conventional American style with slight modifications to suit the narrow gauge track. The entire line consists of single track with the exception of the terminal goods yards and the necessary sidings to provide for the passing of west and east-bound trains.

Writing of single track calls to mind a railway stamp issue that does not include in its designs either a locomotive or a piece of rolling stock! This was Guatemala's 1930 issue to celebrate the opening of the electric railway to Los Altos. There were three stamps, 2c., 3c., and 5c., showing respectively a railway embankment, the Pyrenees Bridge and a section of permanent way, and a station en route. Our illustration of the 3c. value is specially interesting in that there is no indication that the line is electrically operated. The stark simplicity of this stamp forms a most interesting contrast with the design of the 50pf. value of the industrial series issued by the Saar Valley in 1921. This stamp shows a great signal gantry and a maze of sidings at the goods yard at Saarbrücken.

The most interesting of European railway stamps are the Belgian parcel post issues, inscribed Chemins de Fer. The first railway design used in these issues appeared in 1916 and depicted a 2–4–0 locomotive with a very tall chimney and curious steam domes. This design was superseded by a train design in 1920, a very poor effort. It was redrawn in 1921 but, as our illustration shows, the second effort was very little better. The engine apparently has a 4–4–0 wheel arrangement, but the foreshortening in the drawing is so violent as to suggest that the engine cab is no greater in height than the chimney! Belgium's first railway was opened in 1835, by the way. To-day it has over 3,000 miles of railway, excluding some 2,500 miles of light railways.

In comparison with its Congo Colony, Belgium was very tardy in introducing railway stamp designs. The Belgian Congo actually featured a view of a train crossing the railway bridge over the M'pozo River in its November, 1894, issue. The stamp design was used in two later series issued in June, 1909, and January, 1910, respectively. The chief difference in the three issues is in the wording of the name of the country. In the first issue it read "Etat Independant du Congo"; in the second "Congo-Belge," and in the third "Congo-Belge-Belgisch Congo."

Another African representative in the collection will be found in the 2c. value of Eretria's 1930 definitive issue. In this a train of observation cars is shown crossing a viaduct. This stamp, by the way, provides a most interesting comparison of transport types, for, as is clear in our illustration, a camel is shown coming through the centre arch of the viaduct.

It will have been observed that there is a great scarcity of British stamps bearing railway designs. In addition to the New Brunswick and Newfoundland issues already described, British North Borneo and Canada may be added to the list, however. North Borneo issued a train design in 1908 and followed in 1909 with a view of a section of track and a village station.

The Canadian issue is the 20c. express stamp from the Confederation commemorative series of 1927. Strictly this cannot be described as a railway stamp, for its design is symbolical and shows not only a transcontinental express train but a despatch rider, a dog team and a flight of aeroplanes.

In an article such as this it has not been possible to illustrate, or even to describe, more than a few of the stamps that are available. Those readers possessing catalogues will find no difficulty in filling in the gaps we have been compelled to leave. The Stamp Editor has compiled a complete list of such stamps, however, and will send a copy to any reader who desires to follow up the subject more closely.

December Stamp Contest

More than three pages of stamp advertising appear in the "*M.M.*" this month, on pages 986, 988, 990 and 994. Readers would find it profitable to read all these advertisements for there are many bargains on offer. As an encouragement to our readers to do so, we offer prizes consisting of stamps or stamp collecting equipment to the value of 21/–, 15/–, 10/6 and 5/– respectively for the four best letters naming the most interesting bargain and detailing reasons for the choice.

Letters must be sent to "Stamp Bargains," c/o the Editor, and must arrive not later than 31st December. Overseas closing date, 31st March, 1933.

Stamp Gossip

Stamp Reproductions in Advertisements

For many years it has been a grievance of the stamp trade that although the Postmaster-General has allowed publishers to include reproductions of stamps in their news pages, he has declined to permit advertisers to include illustrations of stamps in their advertisements appearing in those self-same publications.

It is welcome news that at last the P.M.G. has seen the light, and in a circular dated 28th October he announces that, subject to certain simple conditions, that prohibition is now no longer operative. Permission to illustrate stamps in their press advertising and lists will now be accorded to approved firms, but that permission will not be extended to include reproductions of current British stamps.

Canadian Stamp Notes

As a measure of economy the Canadian postal authorities have overprinted approximately one million of the old two cent red stamps to convert them into three cent stamps. This is only the sixth time in 71 years that Canada has resorted to overprinting to use up an old issue.

* * *

The Ontario Historical Society Council has submitted to the Postmaster-General of Canada a suggestion that three special stamp issues be made in 1934 to commemorate the centenary of the City of Toronto, the 150th anniversary of the arrival in Canada of the United Empire Loyalists and the 400th anniversary of the discovery of Canada by Jacques Cartier.

Stamp Trade Enterprise

For many years the "*M.M.*" has enjoyed the confidence of the stamp trade as an advertising medium of outstanding merit. This confidence is reflected in the consistent appearance of the advertising of many leading firms.

This month a new record is created. For the first time a stamp firm has taken a whole page to draw our readers' attention to the excellence of its wares. Stanley Gibbons Ltd., the firm concerned, have long been recognised as the world's leading

stamp house, and their enterprise is evidence of their determination to remain on top of the stamp world.

Messrs. Gibbons' advertisement appears on page 994. It would repay careful perusal by all stamp collectors.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

Stamps ! Packet 500 on approval. Pick any at ½d. each.—Wyk, 576, Chester Rd., Manchester.

10 Different Cochin Rajahs Free to Approval applicants.—Kennedy, 27, Newlands Ave., Southampton.

2/6 South Africa Pictorial Free to genuine Approval applicants.—Sanders, 90, Newlands Av., Southampton.

100 Stamps including Persia, Turkey, Argentine. Free. Postage.—Cranwell, 54, Churchill Rd., London, N.W.2.

100 DIFFERENT STAMPS FREE. Send for ½d. Approvals.—Cox, 21, Dennis Mansions, Westcliff.

FREE. 5/- Great Britain to Approval applicants.—Kennedy, 27, Newlands Avenue, Southampton.

2,000 STAMPS. 1d. each. A wonderful choice. Approval.—Roger Cheeseman, Addiscombe Rd., Watford.

Special Offer. 500 different, 1/3; 1,000 3/-; 2,000 9/6; 500 mounts, 2d.—B. Vant, 4, Clifford Avenue, Hull.

QUALITY NOT QUANTITY. 40 diff. Brit. Cols., 7d. post free.—Lucas, 60, Park Street, Bristol.

STAMPS VALUE 2/-, free to all, asking for my bargain Approvals. No rubbish, choose your own gift.—H. Bennett, 15, New Street, Chatham, Kent.

WILL ANY READER EXCHANGE (only) Foreign and Colonial Stamps, medium collector, with Miss Platt, "Arbury," Solihull, near Birmingham, England.

AN XMAS GIFT you must not miss. 25 Mint, Colonials and Foreign free, to genuine applicants for bargain Approvals.—Avenue Stamp Co., 33, Cornwall Avenue, London, N.22.

FREE. 40 Mint and Used British Colonials including Malay States, Australia (Old and New), Ceylon, New South Wales, Jamaica, etc. Request my world famous Approval Sheets and enclose postage. —R. M. Wilkinson, 25, Lawson Road, Colwyn Bay, Wales. (Est. 1889.)

STOP ! ! ! READ THIS. 100 Stamps **FREE**, including the following countries: Indo-China, Mozambique Monaco, Bulgaria, Algeria, Congoland, Luxemburg, Tunis, Jamaica, and **very rare** Thrace (surcharged). Simply send 2d. in stamps to Lee and Carr. 33, Albert Road, Hounslow, **for postage and packing.**

BARGAIN HUNTERS ! Here's your big opportunity. Thousands of different Colonial and Foreign Stamps at ¼d., ½d., and 1d. each. Write now for my attractive sheets. Never such value ! Also medium and good class sent against references. Prices average ⅛th Gibbons.—Campbell, 1, Haldon Avenue, Teignmouth.

DO YOU COLLECT Fine Used British Colonials? Then ask to see my collection of 600 different at ½d. each Stamp, the best value at the lowest cost. Sent on request. A good selection at 1d. each and upwards if desired. Duplicate Stamps Bought or Exchanged. **BICKERS, Elveden, Lordswood Avenue, Southampton.**

EXTRA POCKET MONEY FOR STAMP COLLECTORS
Send Stamp for particulars.
JONES & WRIGHT,
82, Nutbrook Street, Peckham, London, S.E.15.

20 GOOD STAMPS FREE
to genuine collectors applying for my Approval Books. State type of Approvals required.
DEPT. 2, BROADWAY LIBRARY, HERNE BAY.

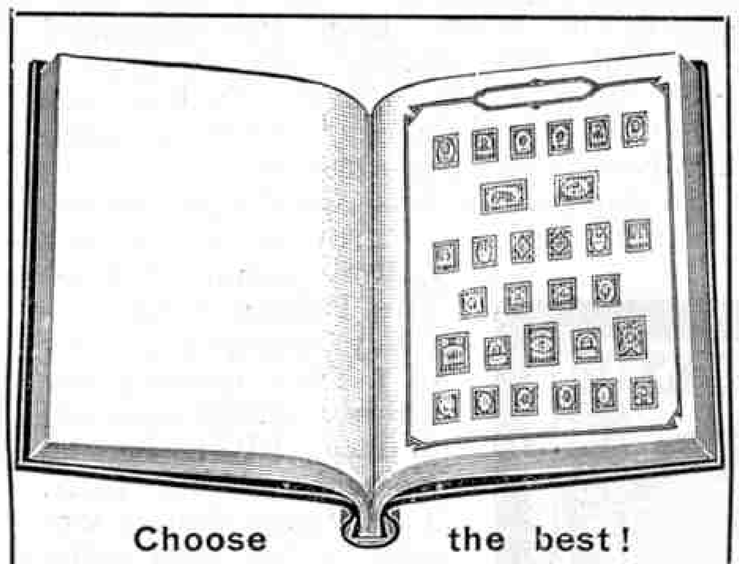
LOOK ! !

FREE ! !
1 B. Colonial (Cat. 4/6)
To applicants for my Approvals I am giving
DURING DECEMBER I AM OFFERING
11 SALVADOR (Cat. 48/-) 1/-

H. R. G. LIDSTONE (Dept. A),
121, STANLEY ROAD, TEDDINGTON.

TERRITORY of **NEW GUINEA** (Air Mail), **ASCENSION** (Pictorial), **GAMBIA** (Pictorial,) all in mint condition and 20 other really Genuine British Colonial Postage Stamps sent free of charge to bona fide collectors making application for selections of Stamps on approval. Reduced Prices. Big Discount. Abroad Post Free 1/-.
HENRY TURNER,
110, Barnett Road, Preston, Brighton, Sussex.

FOUND
Ethiopia, Iceland, Surinam, Inini, Cuba, Antioquia, Philippines, Luxembourg, San Marino, Brazil, etc., etc. A beautiful collection of uncommon stamps FREE. Just request approvals. NO POSTAGE REQUIRED.
THE LEADING
XMAS GIFT
R. HEWSON, 36, Stert Street, Abingdon-on-Thames.



Choose the best!
THE "VIDURA" JUNIOR
"Instantaneous" Spring-back
STAMP ALBUM
This is the ideal method of keeping stamp collections. The leaves are held securely and without injury as in a volume, and can be readily removed when desired for re-arrangement or other purposes. Well made, strong, attractive, built for long service.
Size 9½" × 7½", 75 quadrille leaves, 4/6 each.
Obtainable from good class Stationers, or in case of difficulty, direct from the makers.
PERRY & CO. LTD.
49, OLD BAILEY, LONDON
Works: Birmingham

"DIAMONDS"
MANY RARE STAMPS have been found by purchasers of **The "DIAMOND" Packet,** which contains approx. **1,000 UNSORTED STAMPS** from Convents abroad.
1 pkt. 1/3. 3 pkts. 3/6. 5 pkts. 5/6.
All post free. (Abroad 3d. per pkt. extra.)
O. NERUSH
(Dept. "H"), 68, Turnpike Lane, London, N.8.

Just the thing for your Chum at Xmas
Bean's British Colonial Packets
include Mint, New Issues, High Values and Unusual Varieties.
GOOD MIXTURE, 100 for **1/-**; **SUPERIOR MIXTURE,** 200 for **2/6**; **SPECIAL SELECTION** of 400 all different for **7/6**. Also a good Foreign Mixture at **2/6** for 250. *All post free.* No stunts; no free gifts; all good useful stamps, and full value for the price.
ERNEST F. BEAN, 67, Blackboy Lane, London, N.15.

Bumper Equatorial Packet Free!
This stupendous package contains 300 Unsorted Foreign Stamps, many scarce from FR. SOMALI COAST (Native Drummer), early CHILIAN (Columbus), Egypt, Malacca (Tiger), BRAZIL (Aeroplane), TOGO (Coconut Plantation), and GABOON (fine new issue), etc. Just send 2d. for postage and packing and request large discount approvals. (Abroad 6d. P.O.) Special:—200 different Br. Colonials (No English), **3/6.**
E. LONGBOTTOM & EASTICK,
59, HOLDENHURST ROAD, BOURNEMOUTH.

I AM GIVING up my Approval Department, and taking the Stamps off the sheets and selling them in 6d. and 1/- lots. Remainders of the old sheets have not been touched for years, but they all go in, regardless of catalogue value. It is not possible to give a list of the contents, as every packet is different, but I will guarantee that they are the best value offered. All kinds of stamps go in, Colonials, old issues, new issues, etc. Speculate 6d. or 1/- on a certainty of satisfaction. Postage extra on less than 1/-. Overseas customers may send unused current stamps.
J. A. Swain (P.T.S.), 28, Holmfield Road, Blackpool.

FREE GIFT of an enlarged Palmistry Chart value 1/6. Lots of fun at parties and you are always popular when you can tell fortunes. One Chart given free to everyone sending 1/6 for beautiful British-made Combination Fountain Pen and Propelling Pencil, Non-Corrosive Nib, Self-filler, Pocket Clip, Spare Leads. Worth 5/-. Makes a splendid present and you get the chart free. Pen and Chart 1/6 only. Post free. Money returned if not satisfied.
GORDON, 126, High Street, North Finchley, N.12.

FREE ! 7 GREECE Pictorials (1927)
To Genuine Applicants for my "Peak" Approvals.
S. BACKHOUSE, 61, WARNER STREET, DERBY.

COMPETITION RESULTS

HOME

July "Lynx-Eye" Contest.—Five competitors in this contest succeeded in solving correctly all the 12 pictures illustrated on page 541 of the July 1932 "*M.M.*" The First, Second and Third Prizes have been combined and the total amount divided equally between the competitors concerned, each receiving goods value 14/9.

Goods value 14/9: T. F. Smith (Nottingham); D. Haywood (Bakewell); S. E. Smith (Enfield); C. E. Wrayford (Newton Abbot); J. A. Saunt (Coventry). Ten Prizes of goods value 5/-: F. Downing (Silverdale, Staffs.); G. Ingham (Wath-on-Dearne, Yorks.); J. Bryce (Paisley); J. Willman (Dumfries); C. Spencer (Warsash, Hants.); C. Willard (London, S.W.6); T. Miller (Helensburgh, Scotland); S. Meachem (Birmingham); J. Glanfield (London, N.W.2); C. Jauncey (Heswall, Cheshire).

OVERSEAS

April "Simplicity" Contest.—First Prize, Meccano or Hornby goods value £3-3s.: L. H. Massey (Poznan, Poland). Second Prize, goods value £2-2s.: E. Thorp (Napier, N.Z.). Third Prize, goods value £1-1s.: A. Ness (Port Dalhousie, Ont.). Five Prizes of goods value 10/6: D. Berkin (Kuling, China); W. Jackson (Que Que, S. Rhodesia); D. Johnston (Wellington, N.Z.); B. Pak Yeng (Penang, S.S.); E. Kaye (Baringhup West, Victoria, Aust.).

May "Lynx-Eye" Contest.—First Prize, goods value £2-2s.: J. G. Gnanadurai (Trichinopoly, S. India). Second Prize, goods value £1-1s.: W. Wadley (Johannesburg). Third Prize (tie), goods value 10/6 divided between two competitors: R. Inch (Montreal); A. W. Pasha (Qila Sheikhupura, India). Ten Prizes of goods value 5/-: G. van Eeden (Lusaka, North Rhodesia); E. Stiley (Toronto); R. Taylor (Toronto); L. Osborne (Oakleigh, Victoria, Aust.); A. Khandwalla (Karachi); D. White (Bangalore); D. Atkinson (Nowra, N.S.W.); F. Van Bulck (Brussels); R. Walton (Sydney); R. Atkinson (Sydney).

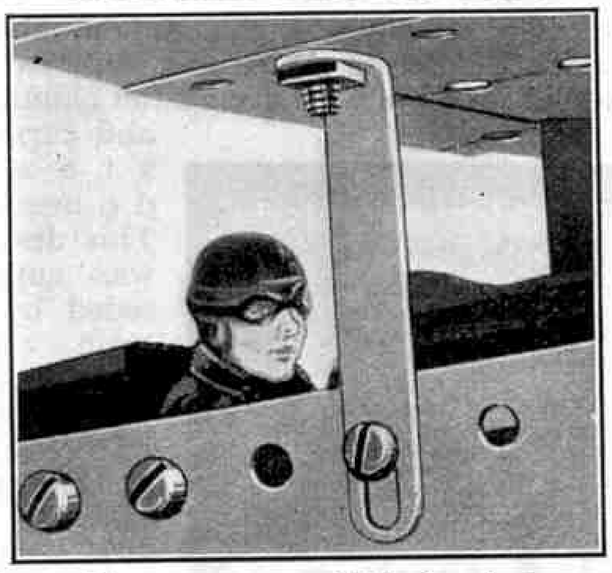
April "Errors" Contest.—First Prize, goods value 21/-: David Parker (North Battleford, Saskatchewan). Second Prize, goods value 15/-: Bruce Jones (Dunedin, N.Z.). Third Prize, goods value 7/6: Jack Smith (Toronto).

CINEMATOGRAPHS British Made from 37/6
CINEMATOGRAPH FILMS
from 5/- per 1,000 ft. Standard size only. Write for our Catalogue, post free, or send 1/- for sample length of Film and Catalogue.
Filmeries Co., 57, Lancaster Rd., Leytonstone, E.11.

FILMS of every description from 4/-. Baers, 176, Wardour Street, W.1. Est. 1907 We buy, sell and exchange.

FOUNTAIN PENS
FREE
Write now for particulars of this wonderful free gift offer and ask for catalogues of Stamps, Albums, Electrical and Chemical Outfits, Models, Cameras, etc. Send 1½d. postage.
Approvals not sent unless especially requested.
S. L. SHELLEY,
34, HAVERING DRIVE, ROMFORD, ESSEX.

Miniature Aeroplane Pilots
Aeroplane Part No. P100



Miniature Pilots are now available for fitting to all open cockpit machines built with the No. 1 and No. 2 Meccano Aeroplane Constructor Outfits. These attractive little figures, which add a wonderful touch of realism, are supplied with green coat and orange cap, blue coat and red cap, or red coat and green cap. Each figure is fixed to a double angle bracket ready for bolting to the sides of the fuselage.

Price **5**d. each.

Meccano Ltd., Old Swan, Liverpool

HORNBY SERIES

HORNBY ACCESSORIES

GAUGE 0

Now is the time to overhaul your Hornby Railway and to decide on the new Accessories you will add to it this Christmas. A selection of popular items, including the new Tunnels and Cuttings, is illustrated below. You will appreciate at once the extent to which any of these Accessories would enhance the realism and effectiveness of your own Hornby Railway. Make your choice to-day—and then see Dad or Uncle about it!

TUNNEL No. 0 (Straight)
Length 6 in., width 6⅛ in.
Price **1/6**

TUNNEL No. 1 (Straight)
Length 7 11/16 in. Width 6¼ in. (as illustrated).
Price **2/–**

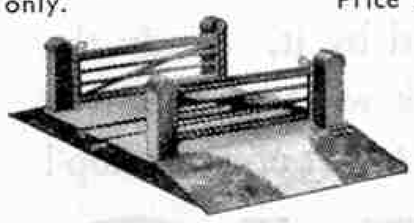
TUNNEL No. 2 (Straight)
Length 15⅝ in. Width 9½ in. Price **4/–**

TUNNEL No. 5
(LEFT-HAND, CURVED)
(as illustrated)
This tunnel is in the form of a small hill, through which the track runs obliquely. For 2 ft. radius tracks.
Base measurement: 15⅞ in. x 14¾ in.
Length of track 17¼ in. Price **7/6**

TUNNEL No. 6
(RIGHT-HAND, CURVED)
Similar to No. 5 Tunnel, but with track in the reverse position. For 2 ft. radius tracks only. Base measurement 15⅞ in. x 14¾ in.
Length of track 17¼ in. Price **7/6**

TUNNEL No. 3 (Curved)
Length 13 in. Price **4/6**

TUNNEL No. 4 (Curved)
(as illustrated)
Length 20 in. For 2 ft. radius tracks only. Price **5/6**

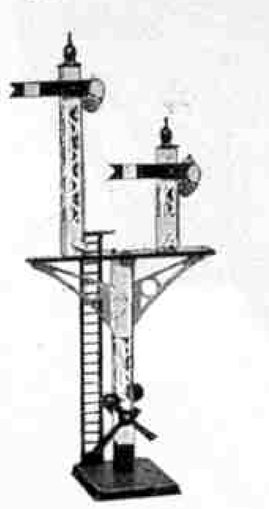


LEVEL CROSSING No. 1
Suitable for a single track only, and has gauge 0 rails in position.
Price **3/6**

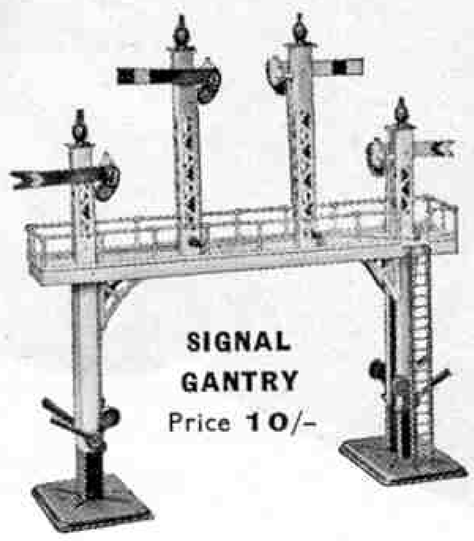
LEVEL CROSSING No. 2
Measures 13½ x 10½ in., with two tracks of gauge 0 rails in position. Price **5/6**

LEVEL CROSSING No. E2
(Electrical)
Similar to Level Crossing No. 2, excepting that a third rail is fitted in each of the two tracks.
Price **7/6**

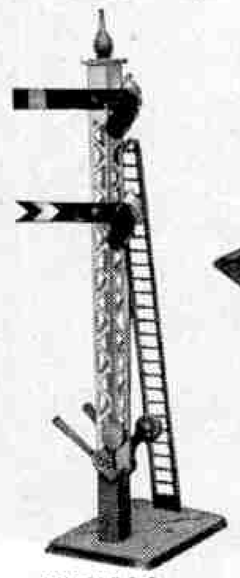
STATION No. 2
Excellent model, beautifully designed. Built up in three detachable sections. Length 2 ft. 9 in., breadth 6 in., height 7 in. Price **10/–**



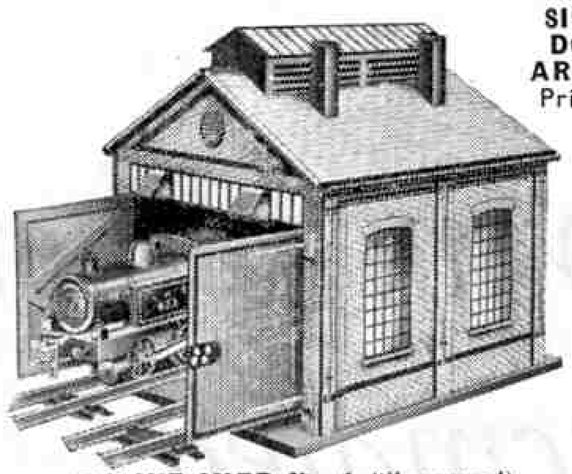
JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. A very realistic model.
Price **6/–**



SIGNAL GANTRY
Price **10/–**

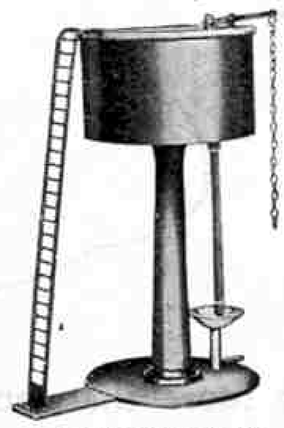


SIGNALS, DOUBLE ARM No. 2
Price each **3/–**

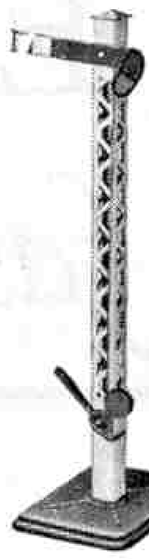


ENGINE SHED No. 1 (illustrated)
This Shed will accommodate Locomotives and Tenders of the M Series, and No. 1 Tank and No. 1 Special Tank Locomotives.
Price **15/–**

ENGINE SHED No. 2
This Shed will accommodate any Locomotive and Tender in the Hornby Series.
Price **22/6**



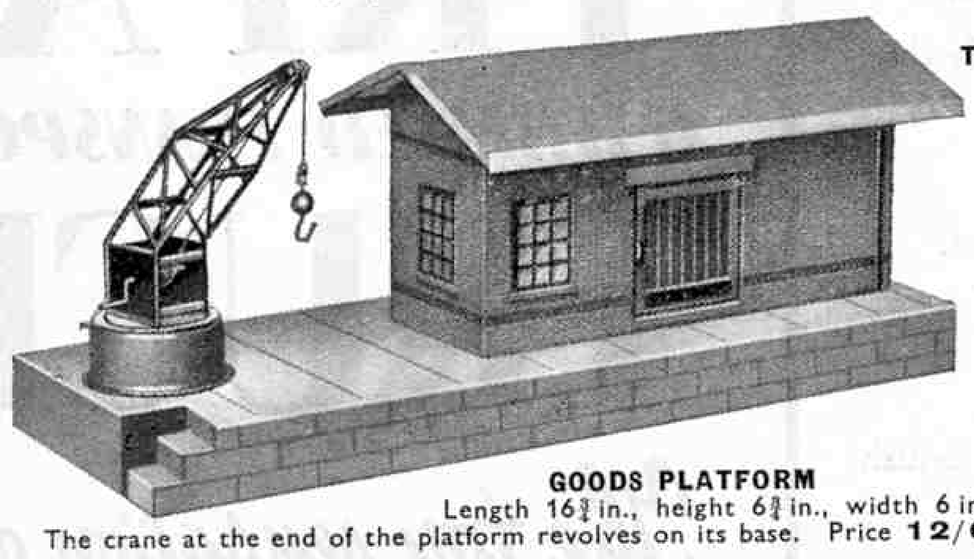
WATER TANK
Fitted with flexible tube and valve lever.
Price **8/6**



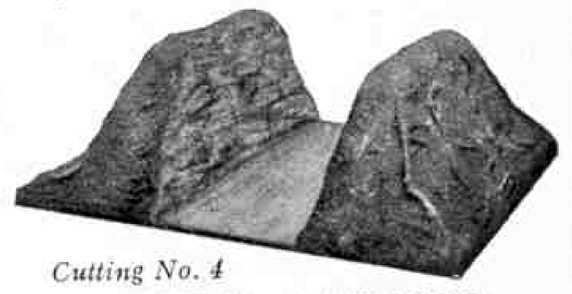
SIGNAL No. 1
Packed in pairs (one "Home," one "Distant").
Price, per pair **3/3**

STATION No. 1
Length 16¾ in., width 6 in., height 6 in. This Station is a well-made model, richly finished in bright colours. By placing several of these Stations at intervals along the track, and using the Railway Station No. 2 as the main terminus, a very realistic effect is given to a miniature railway layout. Price **6/–**

TURNTABLE No. 2
Price **4/6**



GOODS PLATFORM
Length 16¾ in., height 6¾ in., width 6 in.
The crane at the end of the platform revolves on its base. Price **12/6**



Cutting No. 4

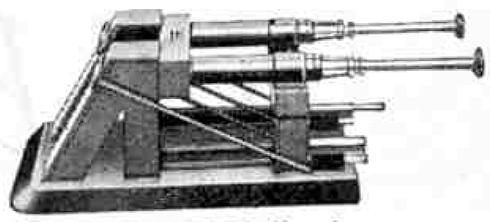
CUTTING No. 4 (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid.
Base measurement: Length 15⅜ in., width 15 in. Price **6/–**

Two No. 1 and one No. 2 Cuttings are illustrated here.

CUTTING No. 1 (END SECTION)
(illustrated)
Base measurement: Length 7 11/16 in., width 6 in. Price, per pair **3/–**

CUTTING No. 2 (CENTRE SECTION, STRAIGHT)
(illustrated)
The addition of these centre sections enables a Hornby Railway cutting to be extended to any length. They are intended to be used in conjunction with the End Sections (Cutting No. 1), between which they are fitted.
Base measurement: Length 10¼ in., width 6 in.
Price **2/–**

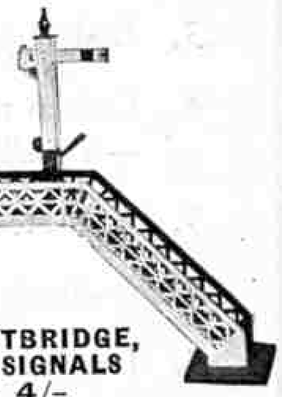
CUTTING No. 3 (CENTRE SECTION, CURVED)
This is used for curved tracks in the same manner as the straight centre section, described above, is used for straight tracks. It is suitable for both 1 ft. and 2 ft. radius tracks. Price **2/–**



BUFFER STOPS No. 2
(Hydraulic type.) Price **5/6**

SIGNAL CABIN No. 1
Finished in colours. Price **2/9**

SIGNAL CABIN No. 2 (illustrated)
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price **4/6**



No. 1 FOOTBRIDGE, WITHOUT SIGNALS
Price **4/–**

No. 1A FOOTBRIDGE, COMPLETE WITH SIGNALS Price **4/9**

No. 2 FOOTBRIDGE, COMPLETE WITH DETACHABLE SIGNALS
(as illustrated). Price **7/6**

Signals only (for Footbridge No. 2)
Price, per pair **3/9**

MECCANO LIMITED — OLD SWAN — LIVERPOOL

Even father will be fascinated!

L. BROS. LTD. LONDON
BROS.
ENGLAND

Regd. Trade Mark

THE 9 POINTS OF THE TRI-ANG TRUCK

1. All parts built to scale, of heavy gauge steel.
2. Bright red and black stove-enamelled, with nickel-plated radiator and fittings.
3. Body tips by one turn of steel handle.
4. Driven mechanically by momentum flywheel —a push, and it goes by itself.
5. Real steering by wheel in cab.
6. 6 wheels with big balloon rubber tyres.
7. Loaded with 6 dove-tailed hard-wood boxes.
8. Weight 6-lbs. Length 20 ins.
9. British made throughout from British materials.

This is something more than an ordinary toy. It is a real engineering job, made from the finest British steel by British craftsmen. A life-like mechanical motor truck driven by a powerful momentum flywheel. A motor truck that will last and last. Every boy will love this model. Every parent will be fascinated by it. Study the 9 points of the Tri-ang truck. Think what a present it would make! And it costs only 10s. 6d. at any toyshop!

TRI-ANG

REGD.

6 WHEELED TRANSPORT

TRUCK 10/6

The toy sensation of the Season

British made by LINES BROS. LIMITED, TRI-ANG WORKS, Morden Rd., Merton, London, S.W.19

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BRITISH FRETWORK OUTFITS AT ALL PRICES — From 1/6 to 42/-

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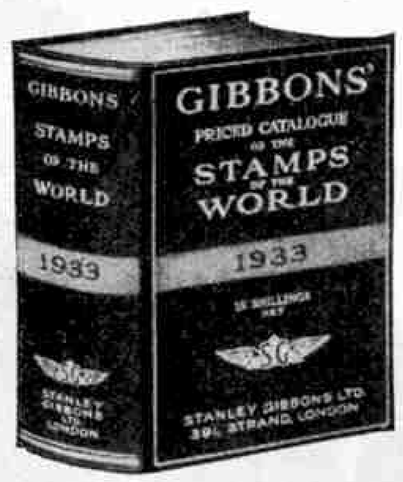

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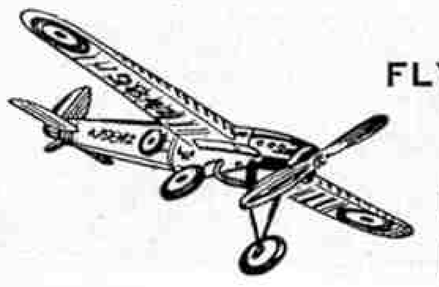

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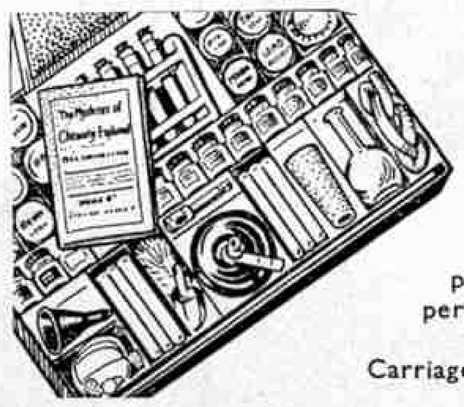

With Bunsen burner, comprising necessary chemicals and apparatus to perform 288 instructive, interesting and perfectly safe experiments. Price **12/6** Carriage and packing 1/–.

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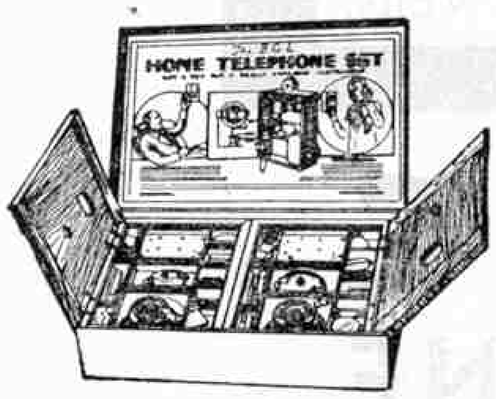

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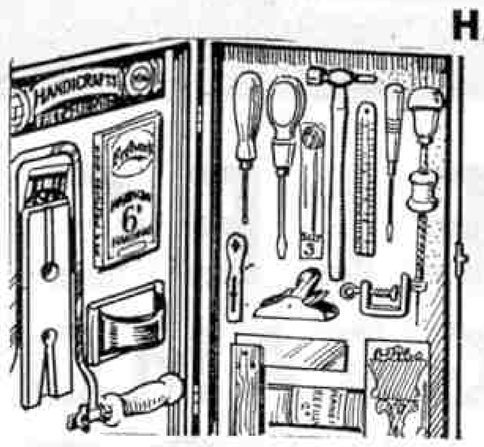

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12 good quality fretwork tools, rule, sand paper block, table and clamp, and Handicraft Hand-Book.

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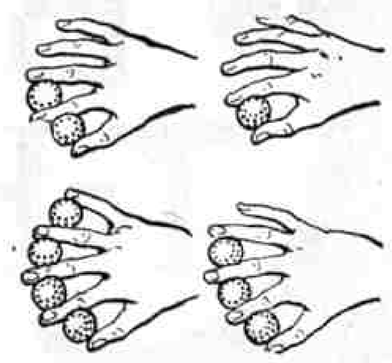
MULTIPLYING GOLF BALLS



First one, then another, and still yet another appear by magic between the finger tips of the performer, simply by magic passes with his other hand. They vanish one by one just as mysteriously. Set of Sponged rubber Golf Balls and full instructions. **5/6** Postage 6d.

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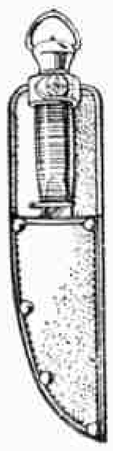

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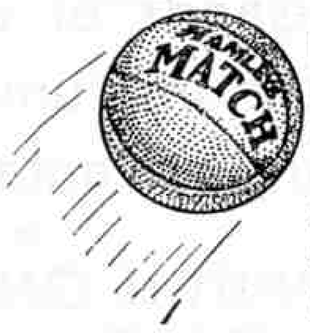

Hamleys "Match" 8-panel machine-sewn cases, of extra heavy selected cow-hide. Size 5, **5/-**
Size 4, **4/6**;
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Size 2, **3/6**. Postage 6d.

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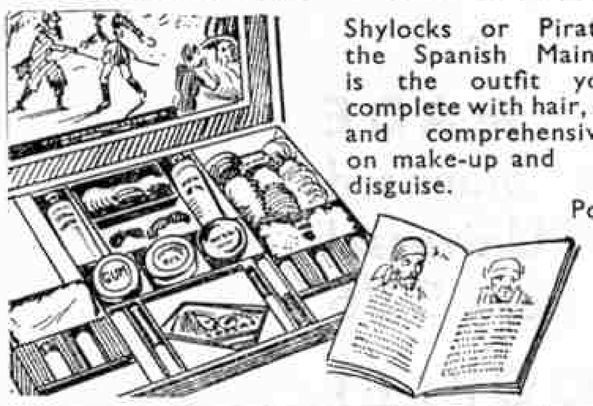

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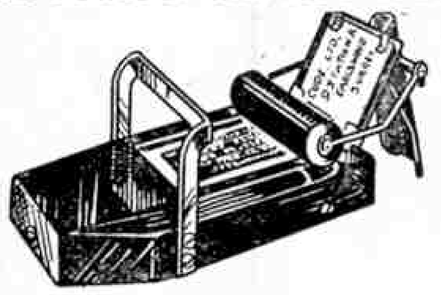

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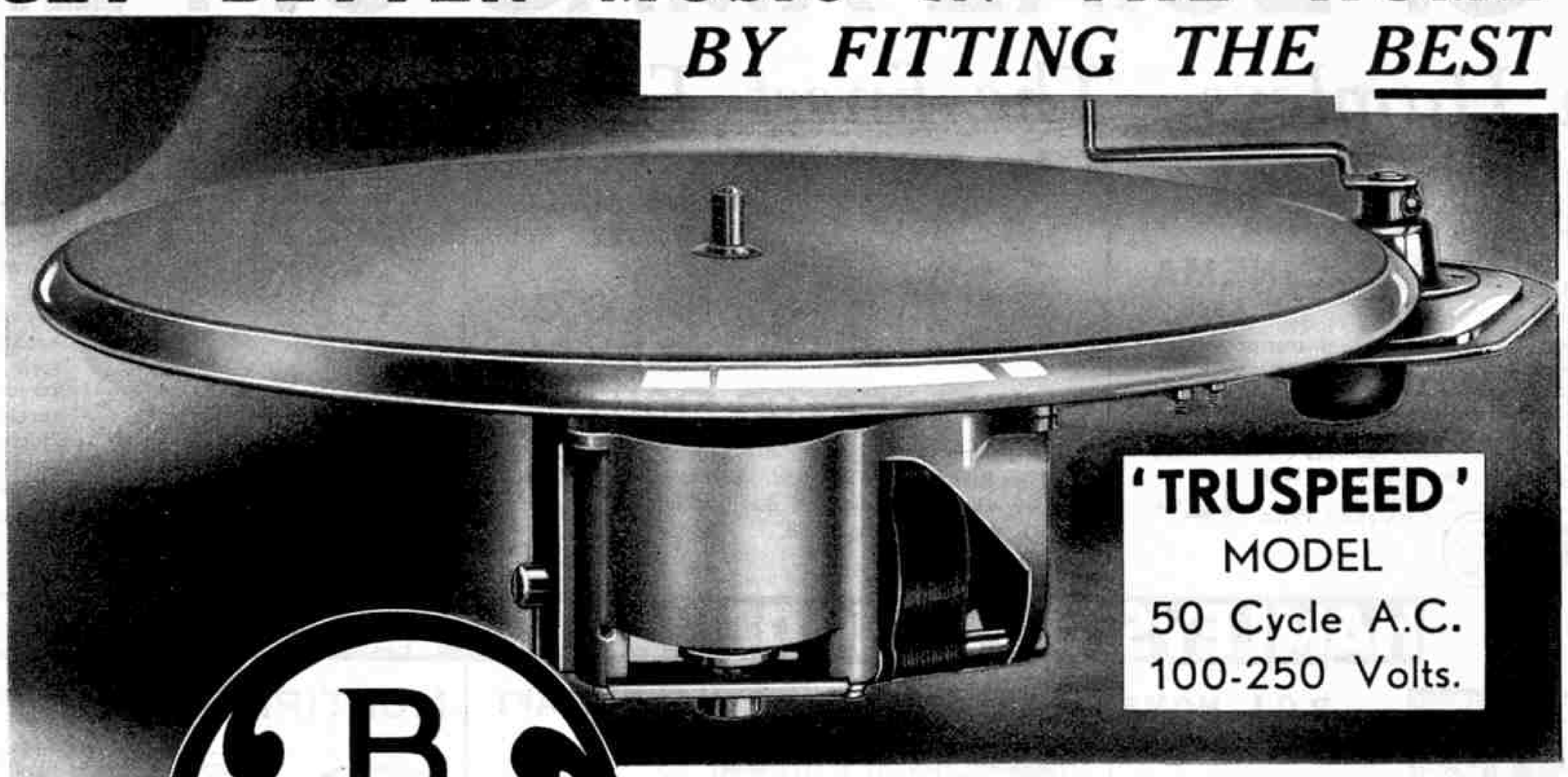
GET BETTER MUSIC IN THE HOME BY FITTING THE BEST



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JUST SWITCH ON
NO WINDING
LOW CURRENT CONSUMPTION
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Head Office: Rugby, England. London Office: "Crown House," Aldwych.
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A 1301.

When they ask what you want for Xmas — Say

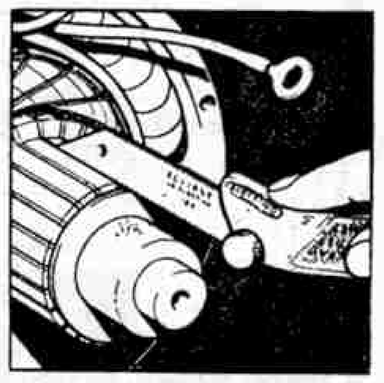
"ECLIPSE" 4S TOOL

Pat. No. 379,052. Reg. Nos. 766,138 ; 767,191 ; 767,192.

Mechanics everywhere are finding a hundred and one uses for this new handy outfit of British Tools. It is a tool-chest in itself—just the thing for a Meccano enthusiast and for home workshops and garages. It comprises one "Eclipse" 4S HOLDER and sixteen tools for Slotting, Sawing, Scraping, Slitting and Filing—all packed in a neat metal container, $5\frac{3}{4}'' \times 1\frac{3}{4}'' \times 1''$.

Scraping main and big-end bearings with curved scraper.

Undercutting the mica of a commutator with the 4S Slotter.



PRICE 5/- PER SET

Obtainable from your usual Tool Dealer

Sole Manufacturers:

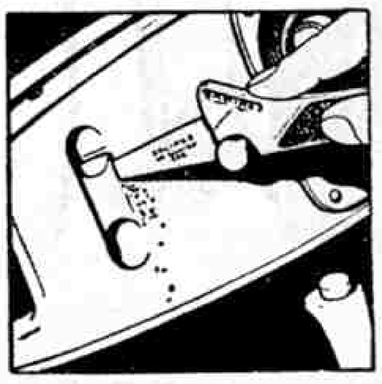
JAMES NEILL & CO. (Sheffield) LTD., Composite Steel Works

SHEFFIELD 11

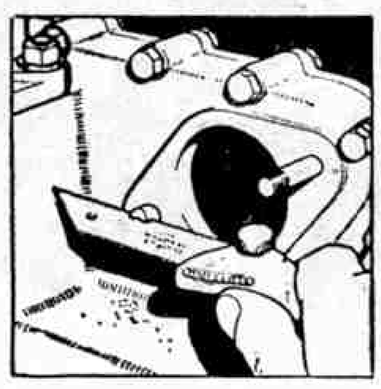
Cutting belts, cutting out gaskets, baring the end of the high tension cable, cleaning plug points, etc.

Cutting of rusty bolts and seized screws.

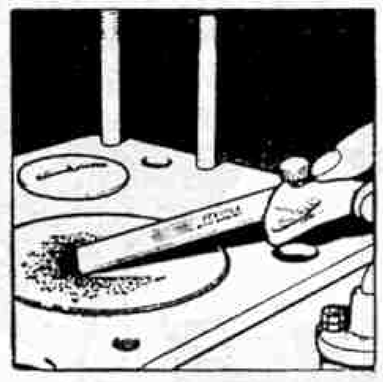
Cutting holes in large surfaces of metal or wood by joining up drilled holes.



Slotting broken studs for removing by screwdriver, trimming up damaged screwdriver slots, scraping brake linings, etc.



Flat-scraper for de-carbonising, preparing surfaces for enamelling or soldering, removing old paint, old gaskets, etc.



Box 1. Price 3/6

LOTT'S CHEMISTRY

Lott's Chemistry is great fun. You may not get much chance in the school "lab" to do as you like, but here are sets ready to hand that will give you endless pleasure. The larger sets provide apparatus for the preparation of Gases and other processes. An illustrated booklet of experiments, which can be performed with the contents of the respective box is contained in each set. The chemicals are packed in special lever lid cartons, and screw capped glass bottles to avoid deterioration (3/6 size in corked bottles).

Obtainable from all leading Toy Dealers and Stores

BOX 1. Contains 18 chemicals, test-tubes, tin dishes, filter papers, litmus paper, magnesium ribbon, glass tubing, test-tube cleaning brush, and Book of 42 Experiments. **Price 3/6**

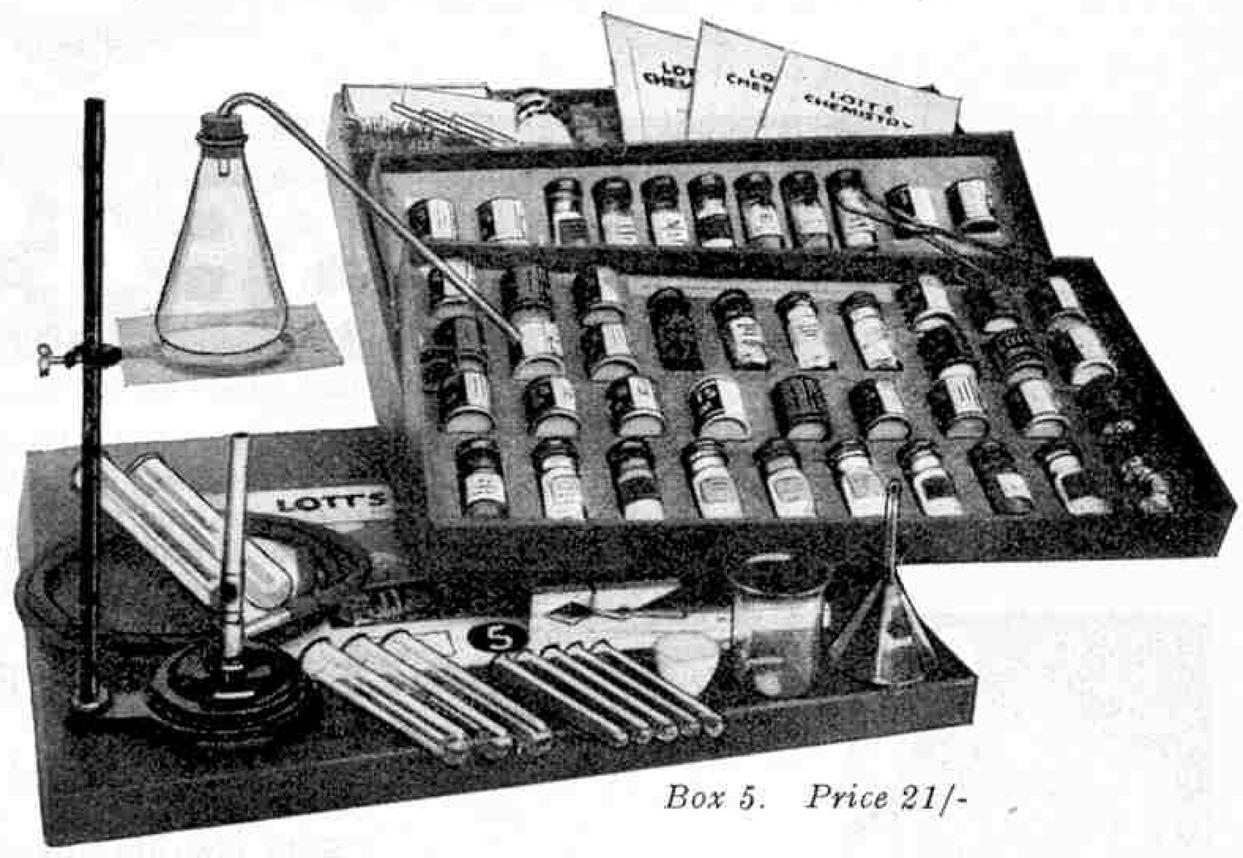
BOX 2. The addition of a good quality Bunsen Burner, with rubber connection tube makes Box 2 an attractive low priced set. Contains also 22 chemicals, test-tubes, etc., etc., and Booklet of 80 Experiments. **Price 6/-**

BOX 3. This set is a great advance over No. 2, as in addition to 30 chemicals, it contains a flask with rubber cork and delivery tube, porcelain crucible, glass funnel for filtering and extra test-tubes and glass tubing. The Book of 131 Experiments contains a number of unusually interesting reactions. The entire contents of the earlier sets are of course included in Box 3. **Price 10/6**

BOX 4. The advantages of this box lie chiefly in its larger number of 38 chemicals, and consequently increased range of 181 Experiments. Additional apparatus includes two extra large test-tubes and a very convenient form of wooden test-tube holder. Contains also Bunsen Burner, etc., etc., as in the previous sets. **Price 15/6**

BOX 5. An especially fine set, Box 5 contains 43 chemicals, and apparatus for a remarkable range of 228 Experiments. The additional apparatus over and above the contents of the earlier boxes includes Retort Stand and ring (of great use in arranging the apparatus in a firm and convenient form), wire gauze, beaker and crucible tongs. Extra bottles of some of the chemicals most frequently used are also included. **Price 21/-**

Box 3. Price 10/6



Box 5. Price 21/-

Box 7. Price 42/-

BOX 6. Sets Nos. 6 and 7 are large sets in the form of cabinets with 3 removable trays. No. 6 includes 23 bottles and 27 cartons of chemicals, 50 in all. Extra apparatus not contained in the previous boxes includes: second ring for retort stand, deflagrating spoon and cap, pestle and mortar, and two glass stoppered bottles. Full instructions on the use of this apparatus are included. **Price 31/6**

BOX 7. This Cabinet embraces all the apparatus and possibilities of the whole series of Lott's Chemistry sets, and provides the young experimenter with a really useful range of laboratory equipment. It contains 54 bottles and cartons of chemicals. Extra apparatus includes glass retort, sand bath, tripod, pipe clay triangle, and two glass stoppered bottles. Complete with full instructions and notes on the use of the apparatus. **Price 42/-**

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BOYS! Here is something you've often wished for—a Real Printing Machine! Not a toy or a model but an Automatic Self-Inking All-Steel Adana Machine which uses real Printer's Metal Type and produces work just like that done by Professional Printers.

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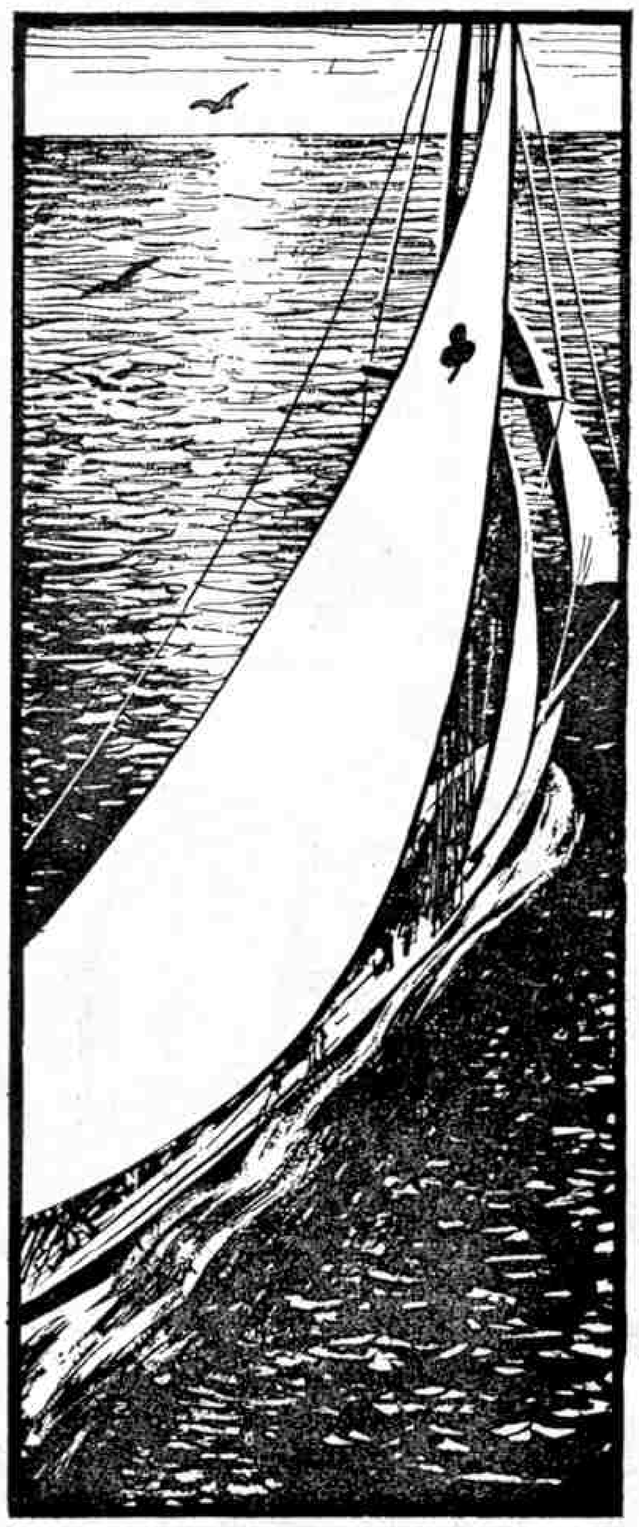
Cut out this Coupon and Post at once with your full name and address attached.

SECCOTINE

REG'D.



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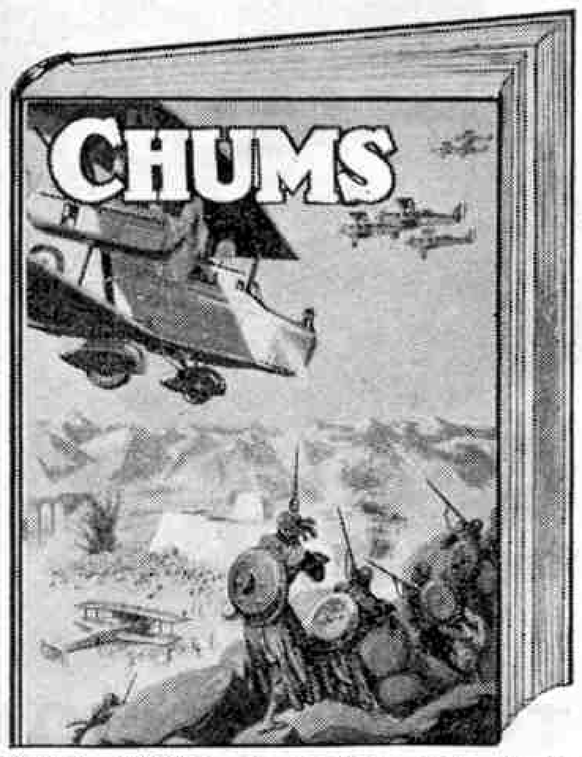
All these Annuals are now on sale at all Newsagents, Booksellers and wherever books are sold.



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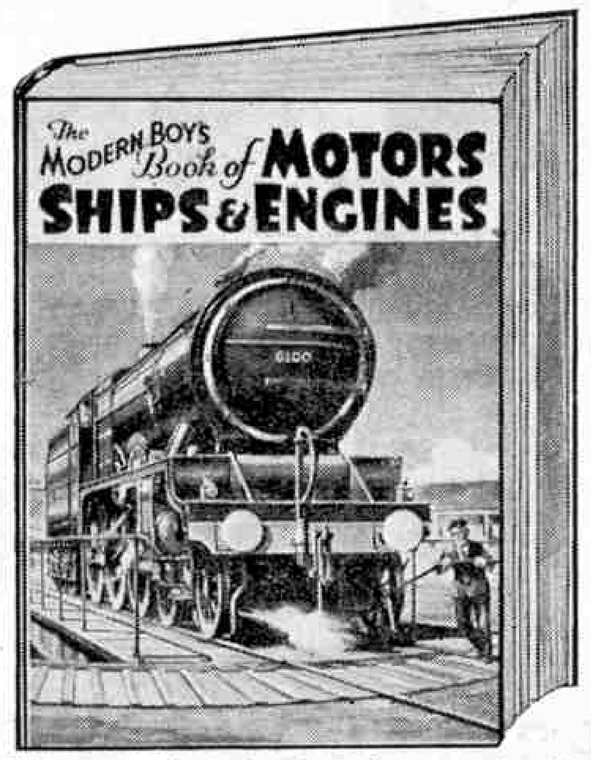

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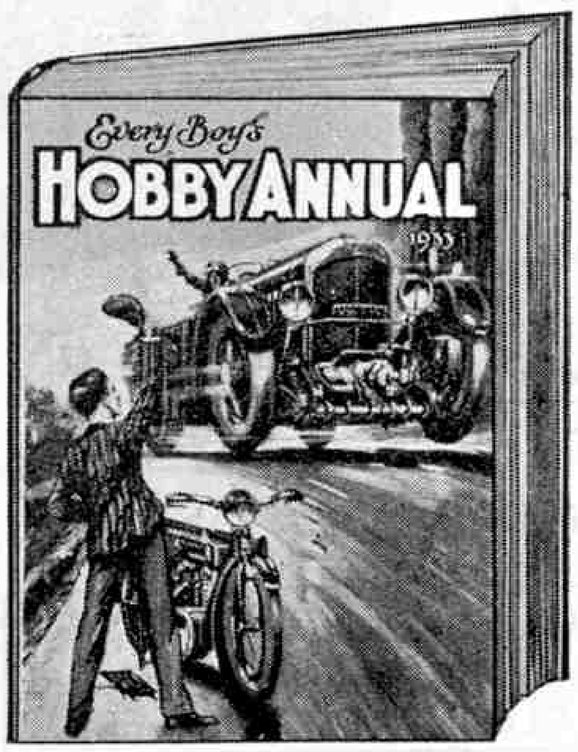
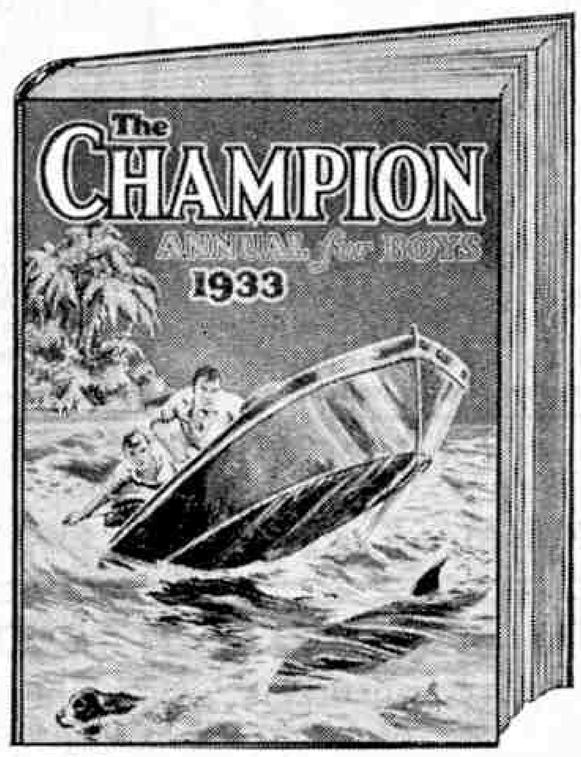


THE fascination of discovering "How It Works," and "How To Make" is blended with lively talk about the world's most recent mechanical wonders, with hundreds of illustrations and two large folding plates in photogravure. **6/-** NET.



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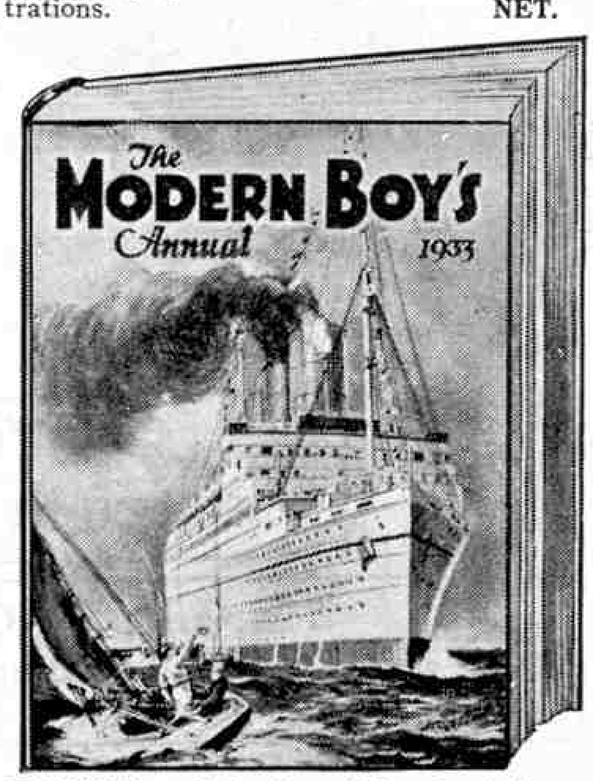

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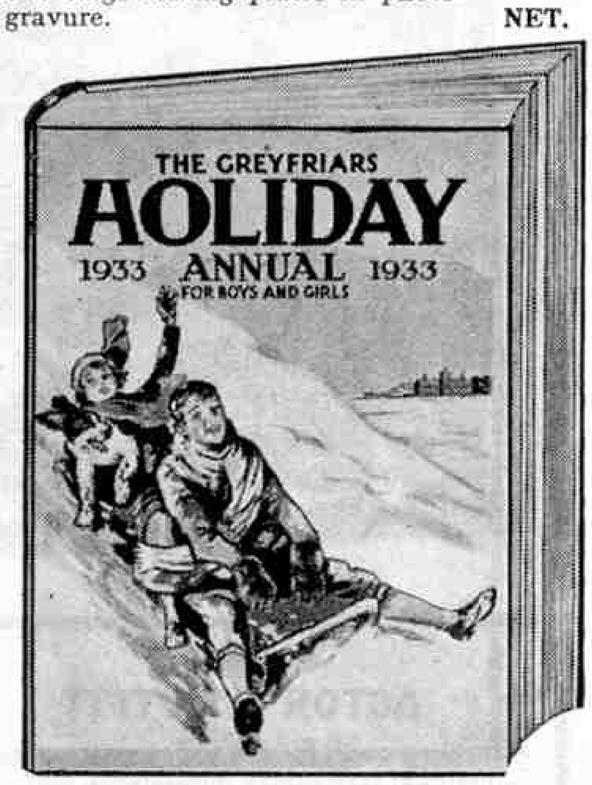

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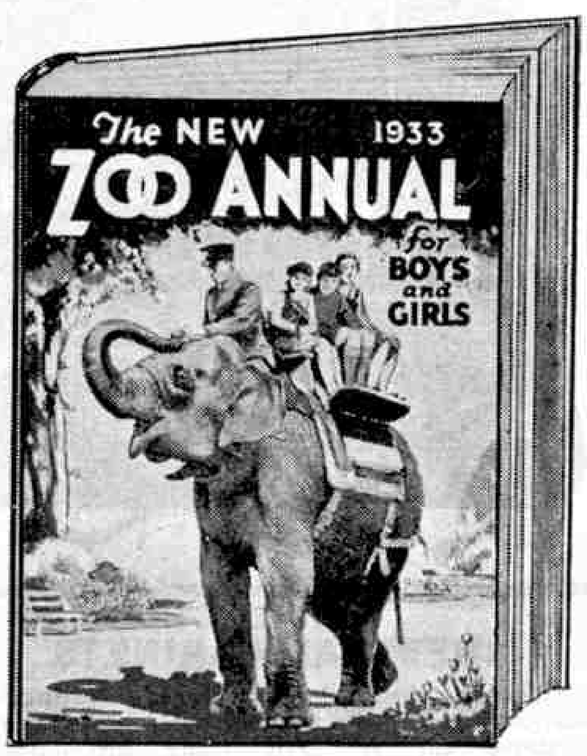

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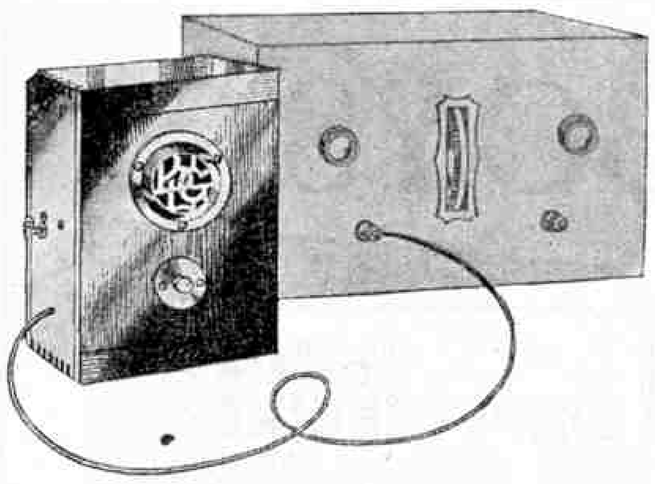

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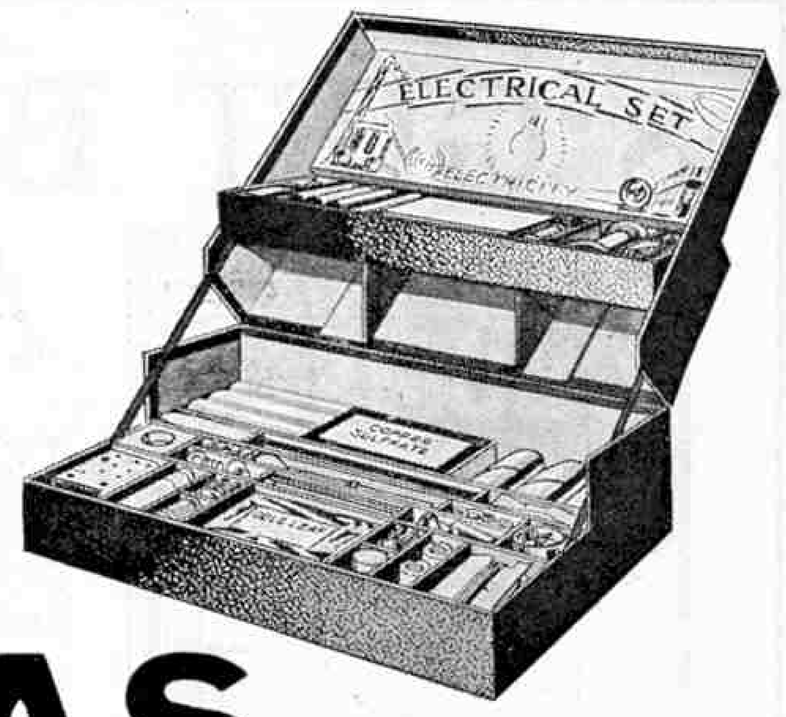

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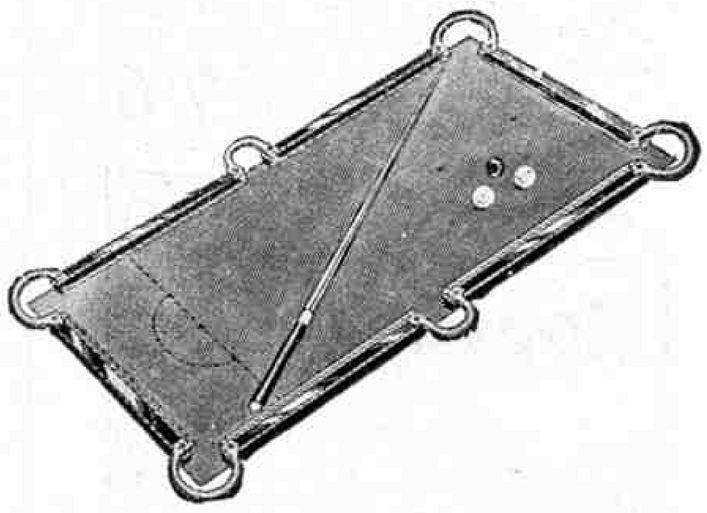

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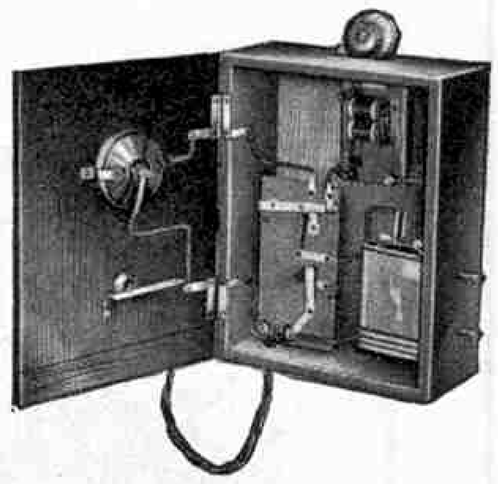

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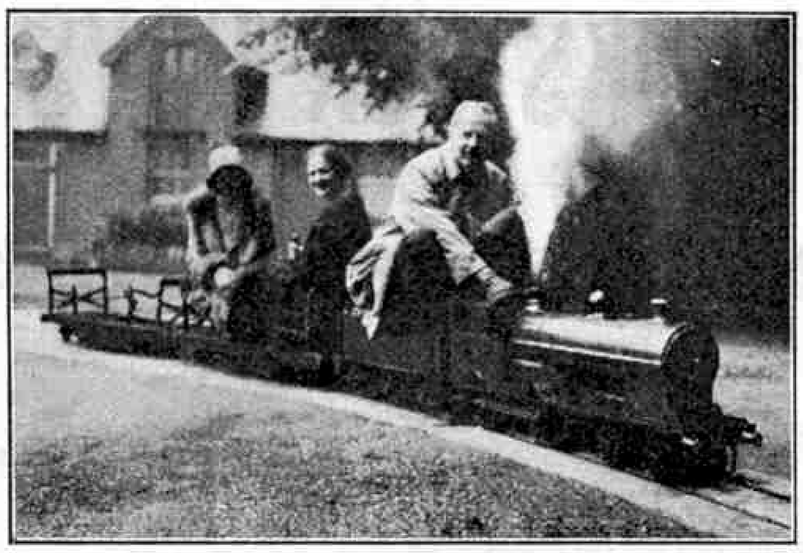

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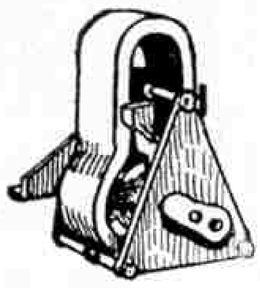

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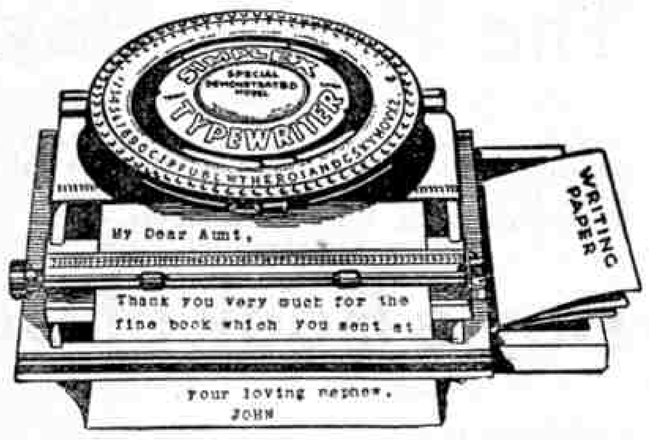

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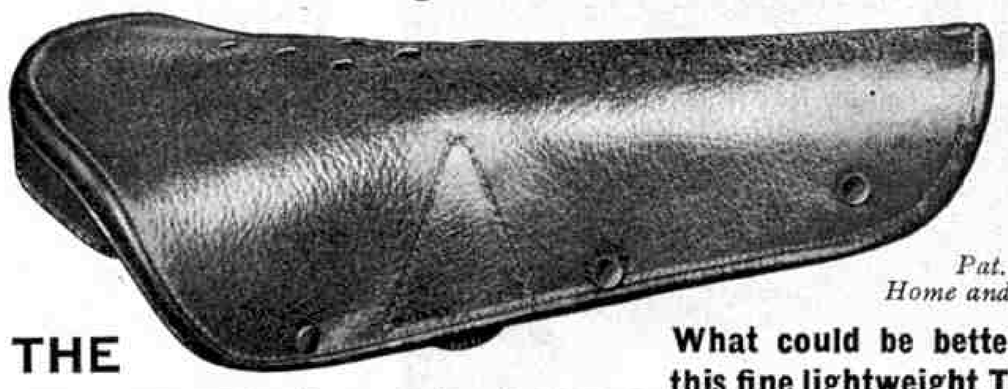

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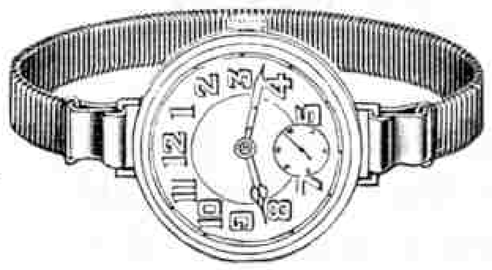

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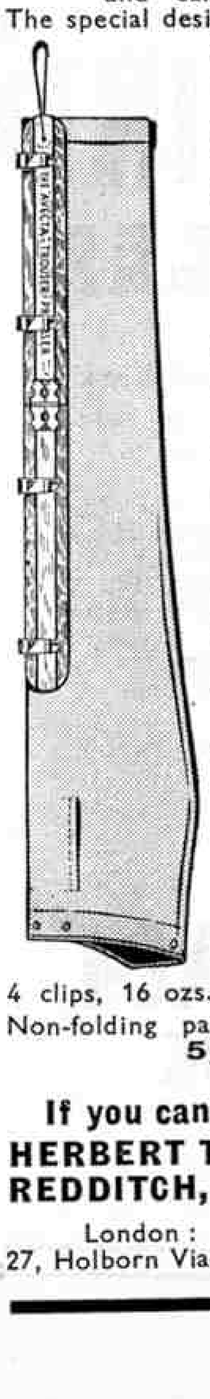

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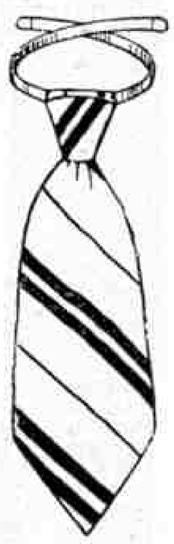

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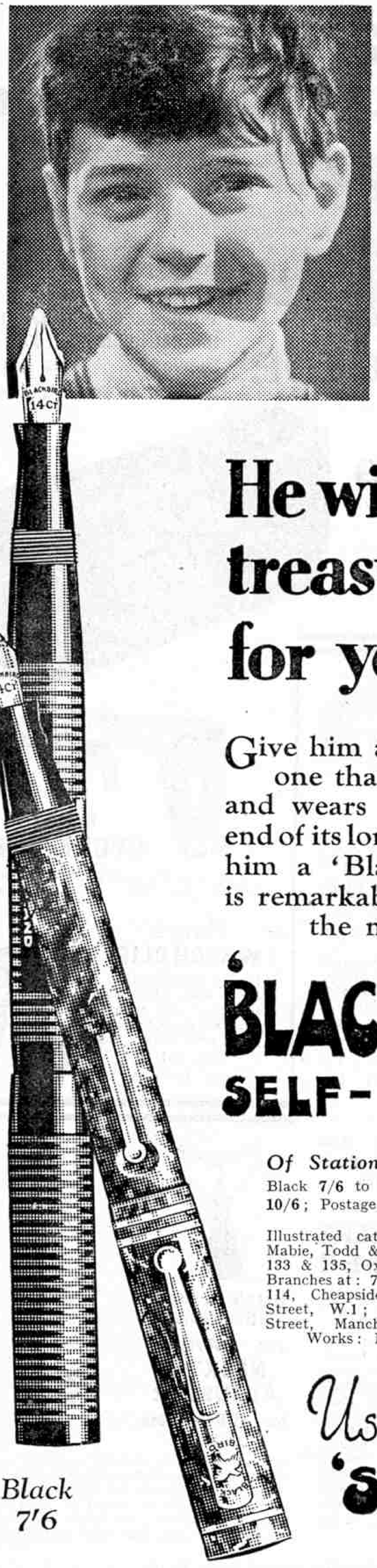

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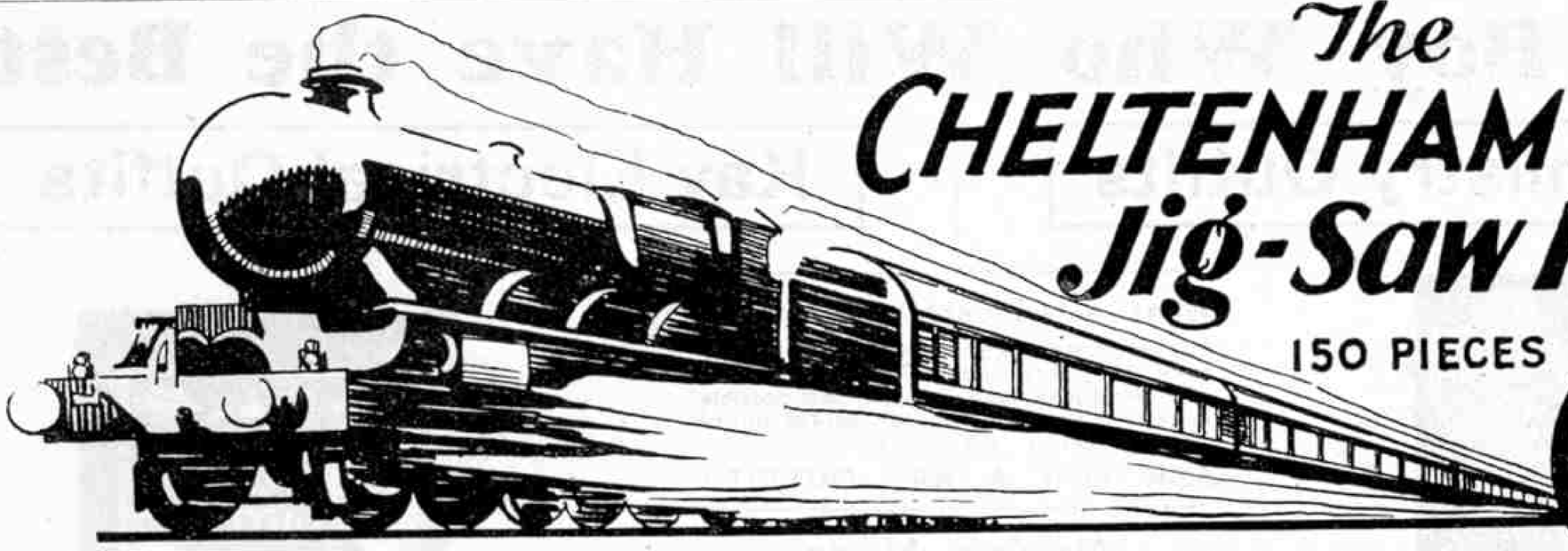

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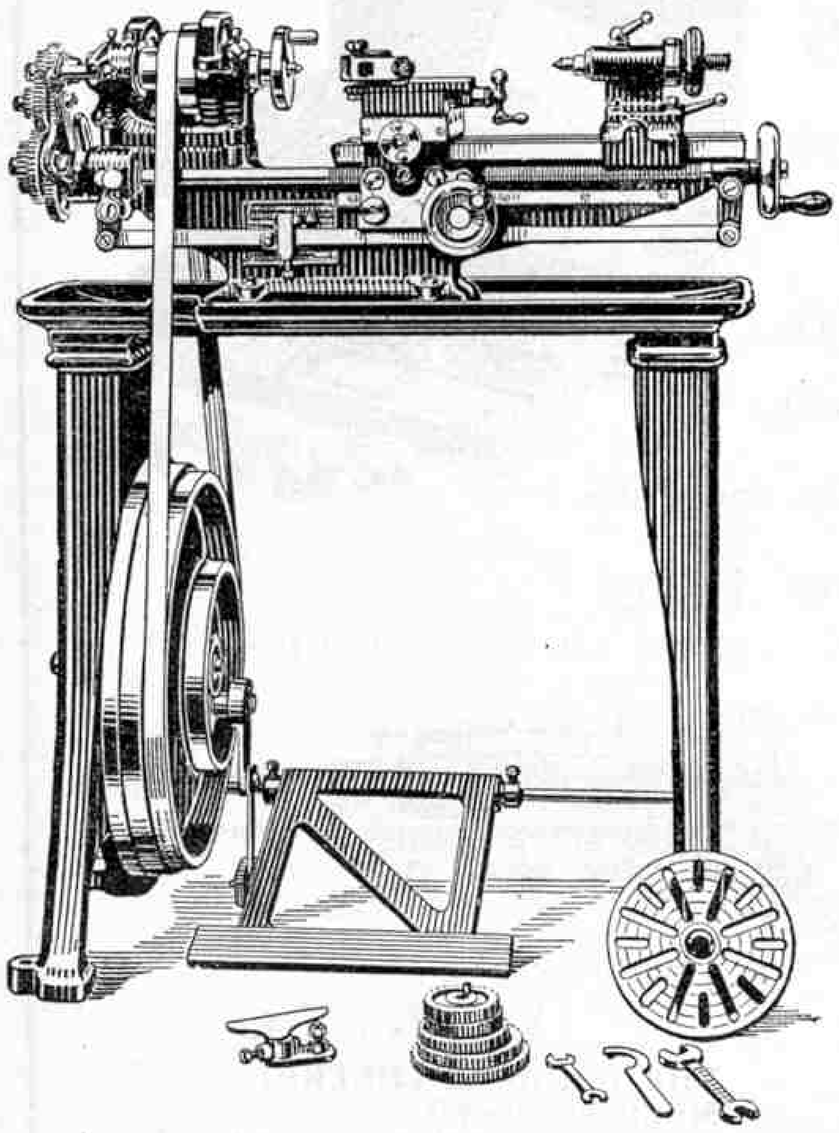

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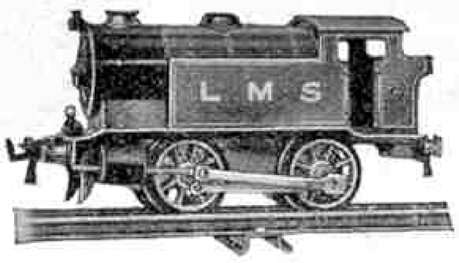

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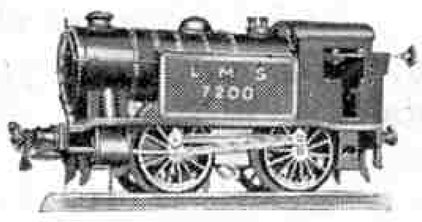

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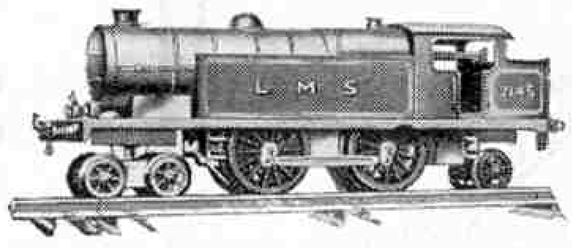

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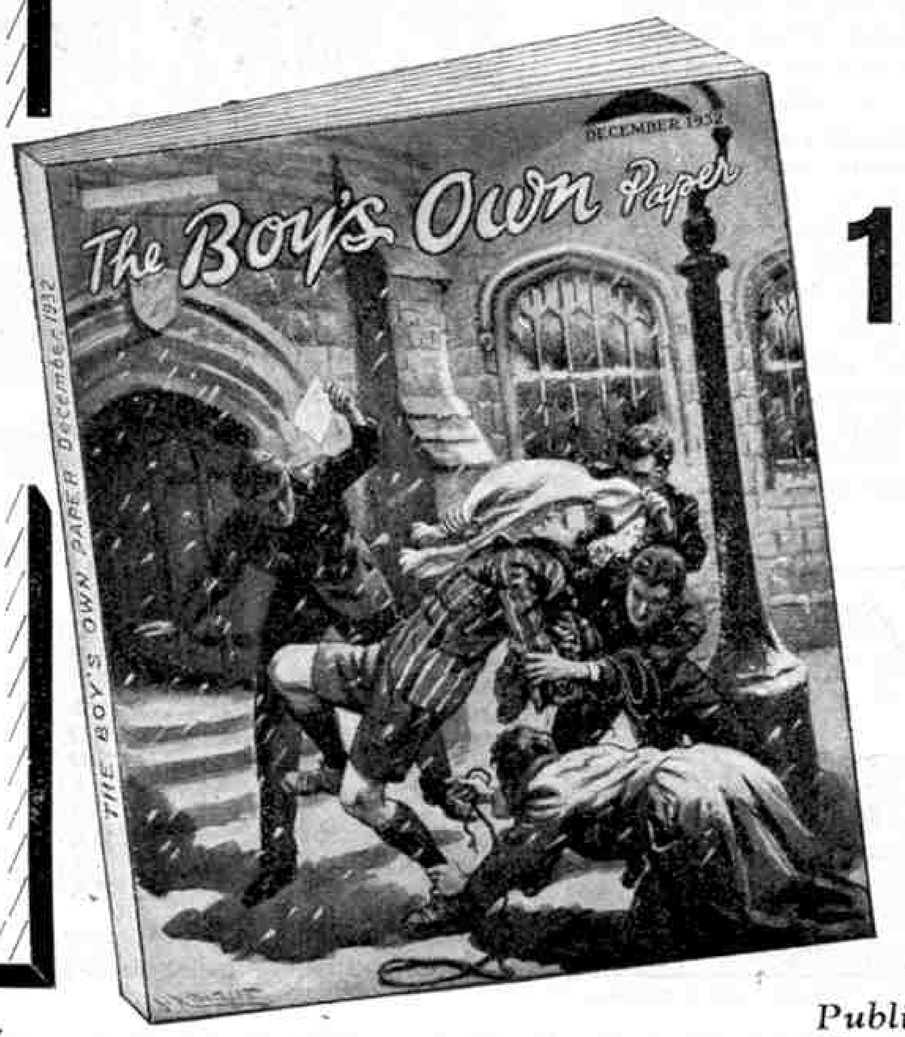

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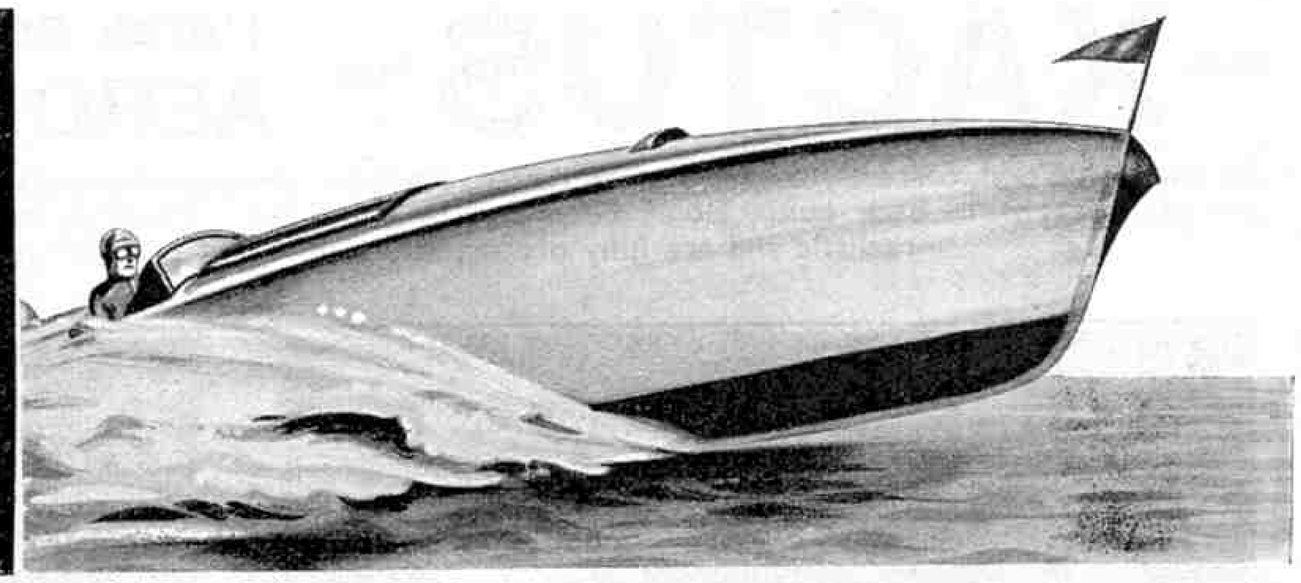
HORNBY SPEED BOAT

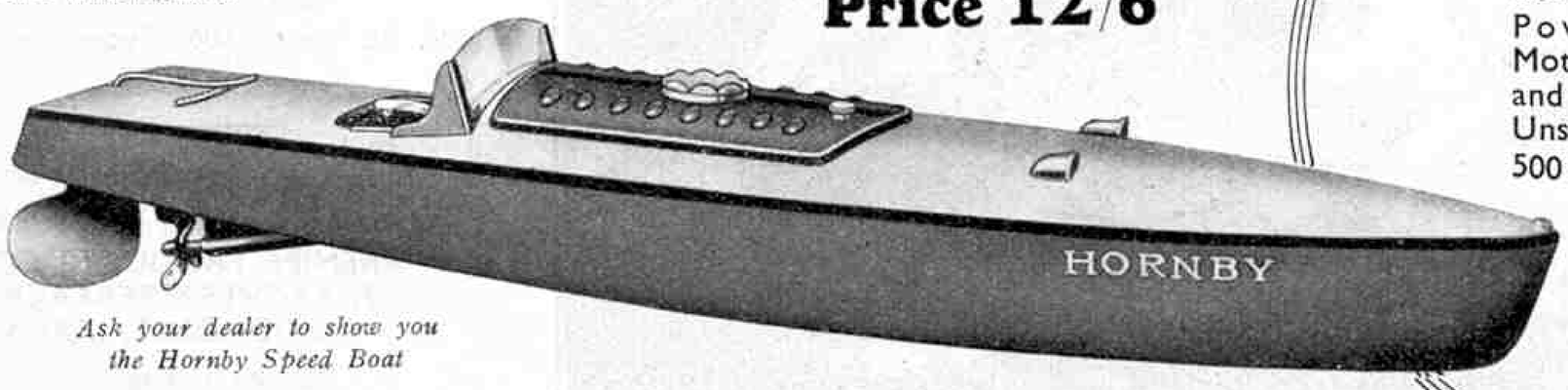


500 feet on one winding!

Boys ! The Hornby Speed Boat is the finest craft you ever saw, with speed and endurance written in every inch of her stream-lined hull. On one winding of the powerful clockwork motor she races away for a distance of 500 feet, smoothly riding the waves, just as real speed boats do.

The Hornby Speed Boat measures 16½ inches from bow to stern and 3½ inches in beam. She is available in three different colour combinations—Green and Ivory, Red and Cream, and Blue and White. Her motor is designed and made on the same lines as the motors of the famous Hornby Trains. She is a perfectly constructed model, with water-tight bulkheads that make her absolutely seaworthy and unsinkable.

Price 12/6



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Beautiful finish.
Powerful Clockwork Motor giving high speed and great length of run.
Unsinkable.
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Up-to-date fittings, comprising Windscreen, Brass Ventilators, Adjustable Rudder, etc.

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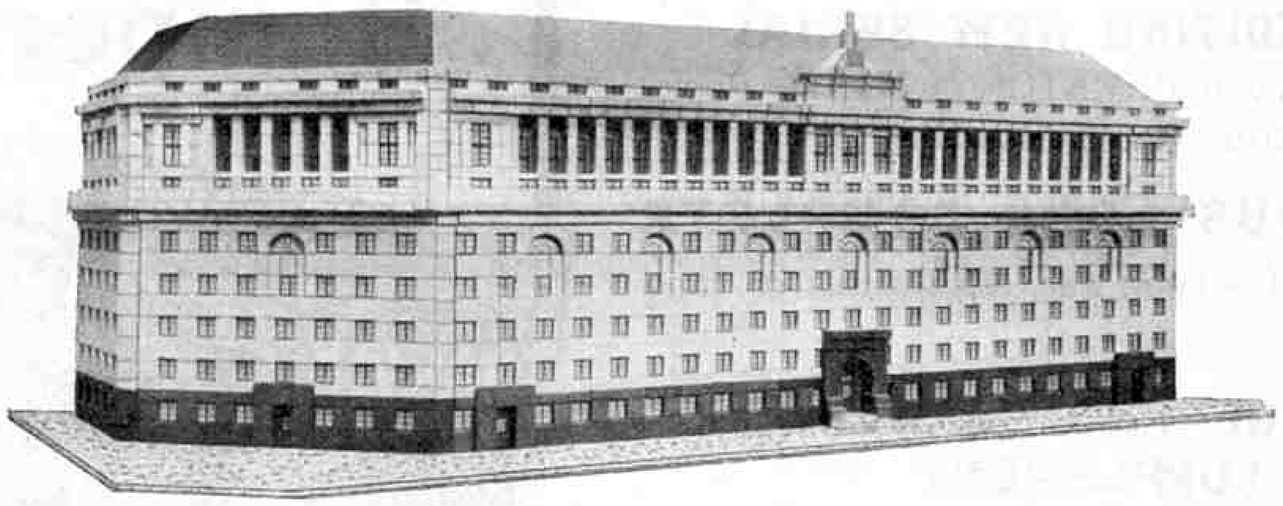

The model illustrated above is built entirely ith Lott's Bricks and measures over 5 feet long. Readers may notice the resemblance to one of London's big new buildings.

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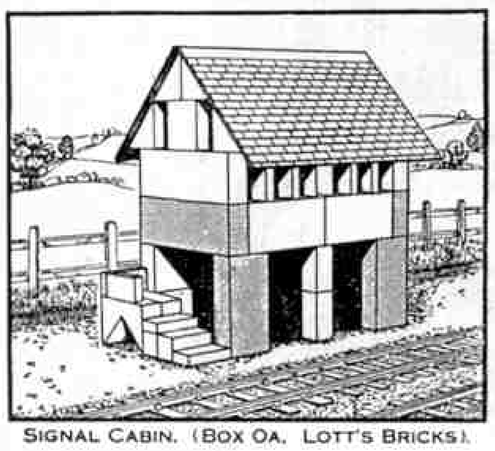

SIGNAL CABIN. (BOX OA. LOTT'S BRICKS).

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,,	3.	36 ,,	...	21/-
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,,	1A.	(Supplement)		4/6
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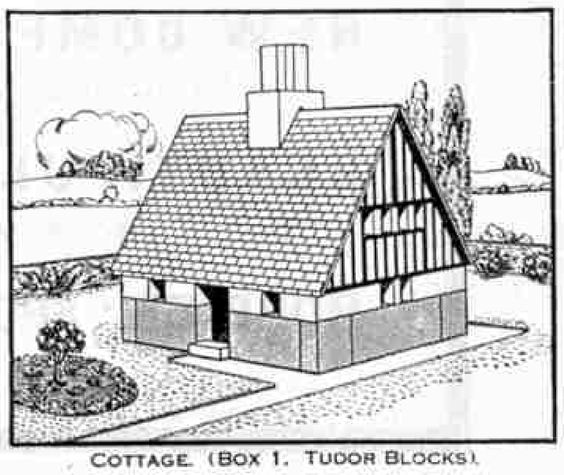
Railway Box		...	...	17/6



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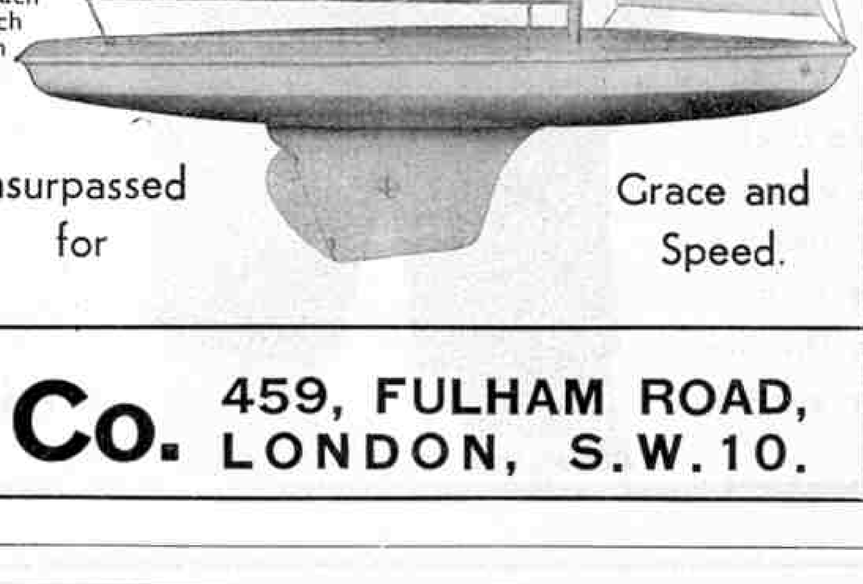

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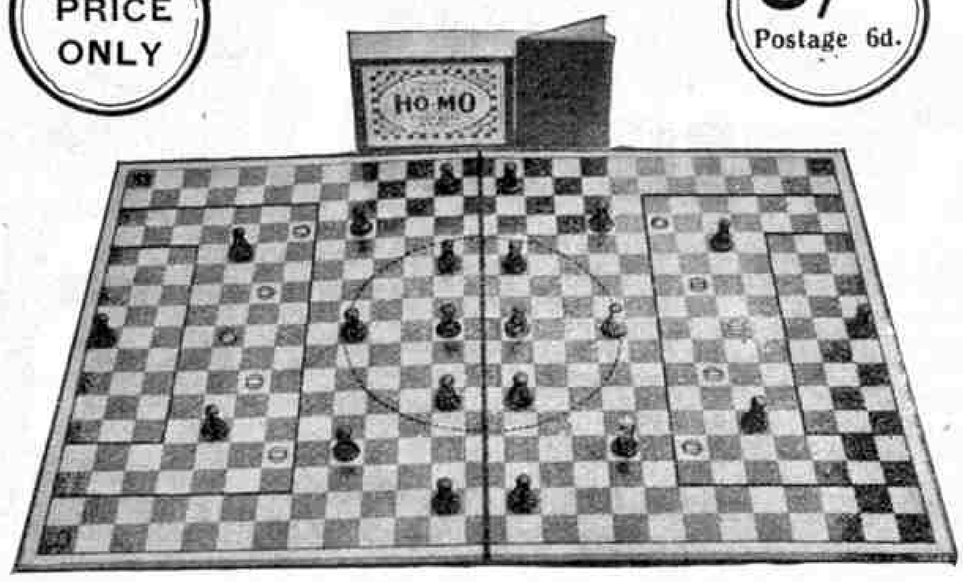

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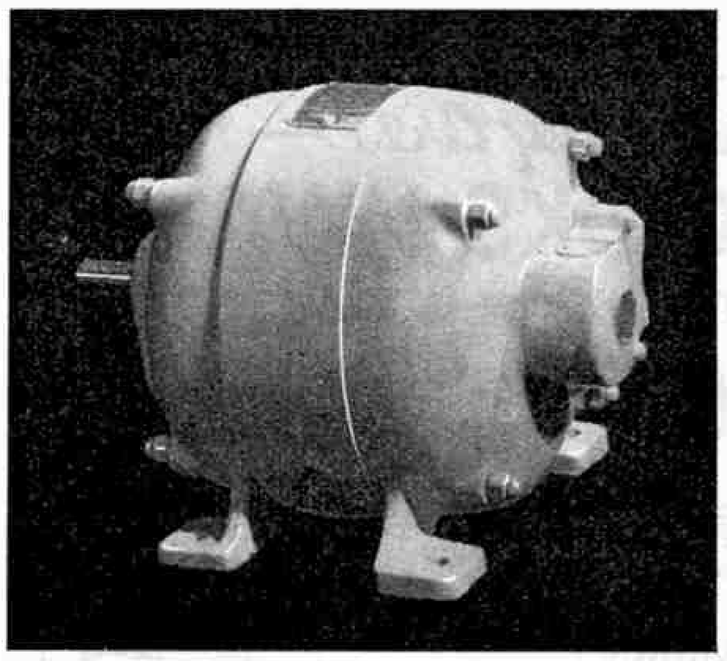

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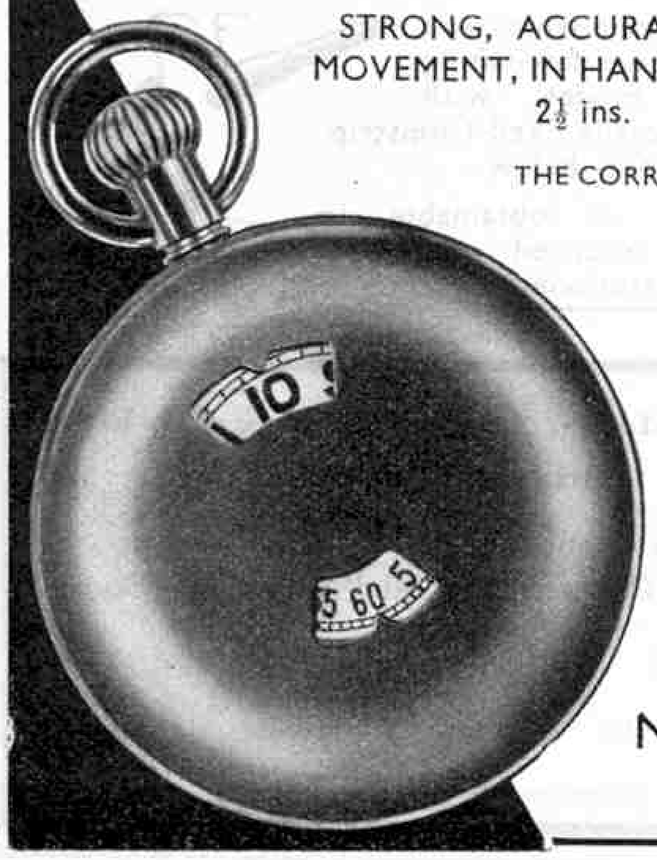

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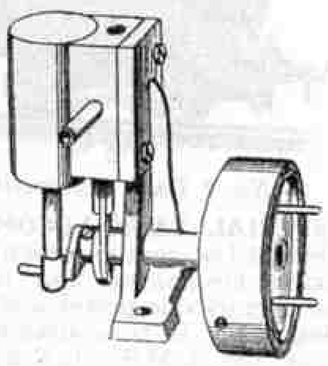

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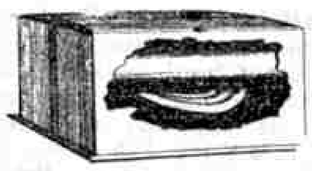

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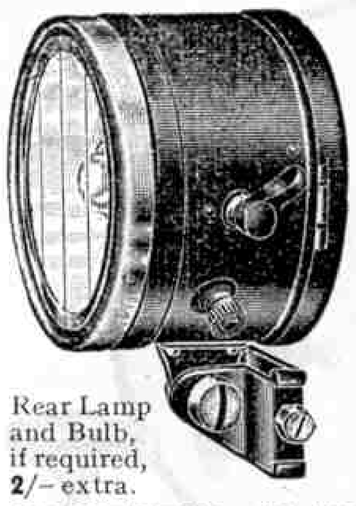

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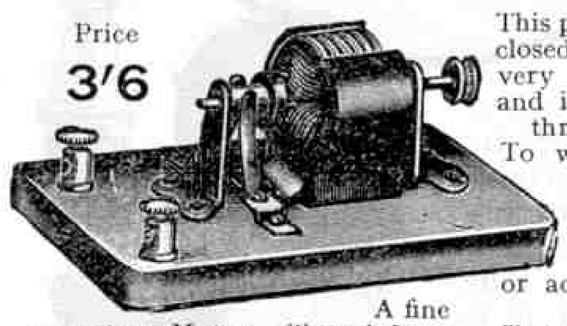

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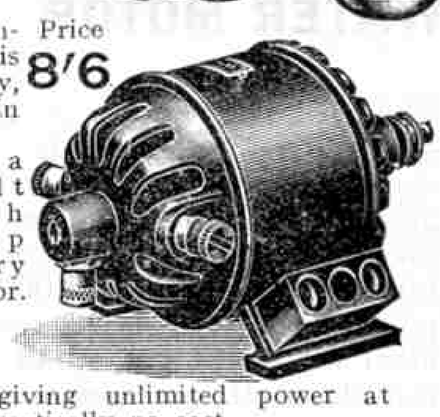

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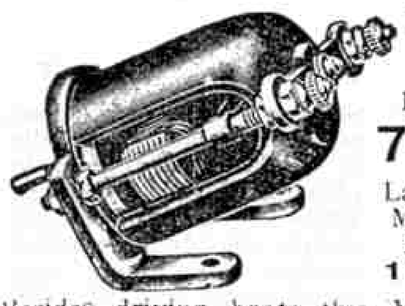

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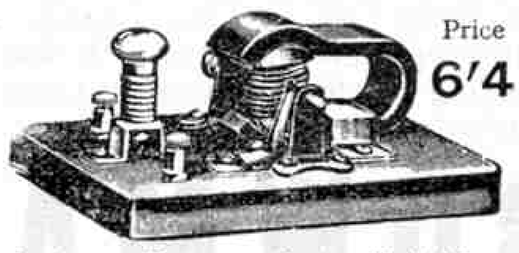

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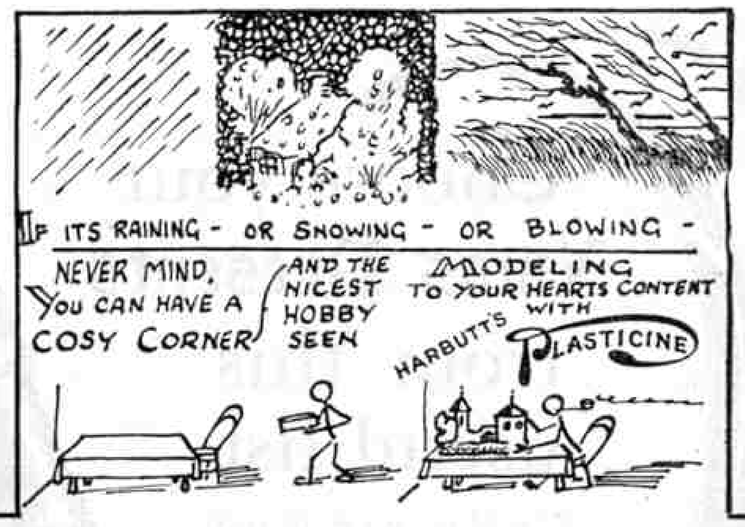

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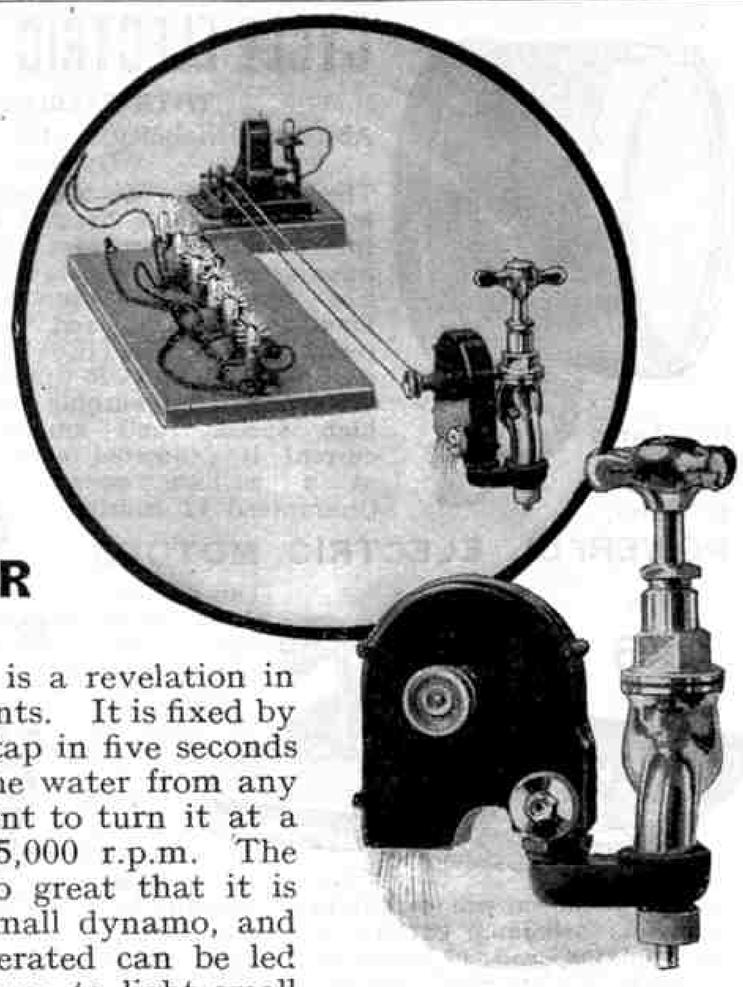

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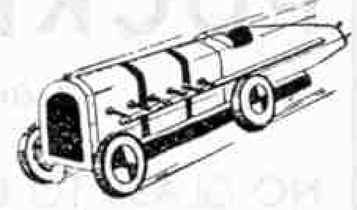

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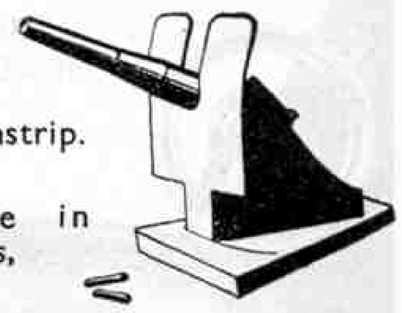

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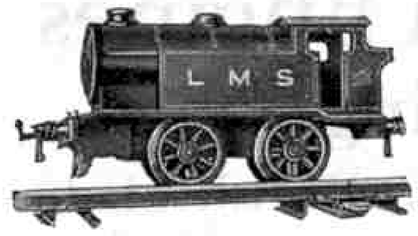

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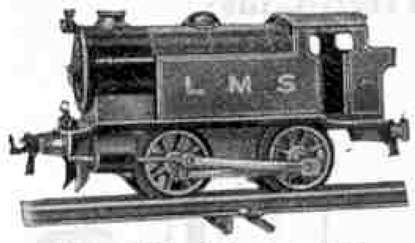

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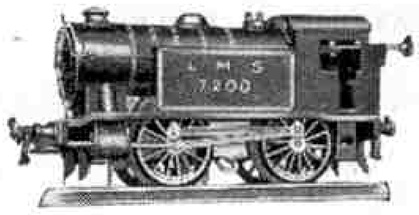

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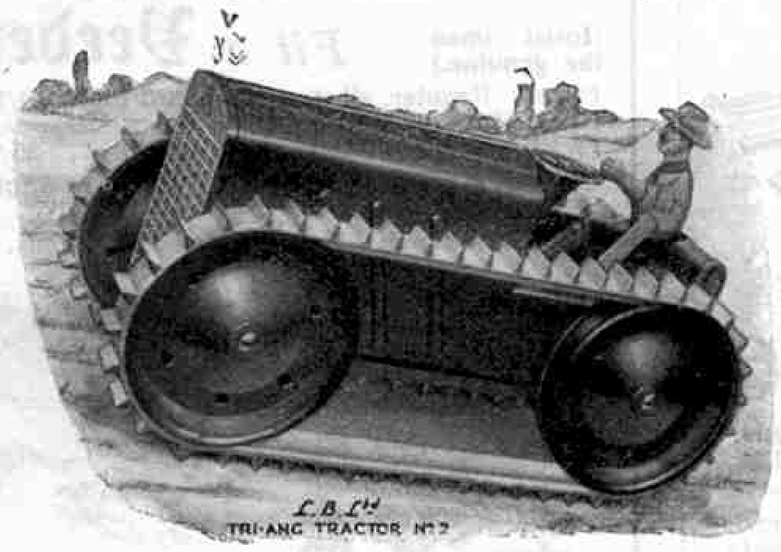

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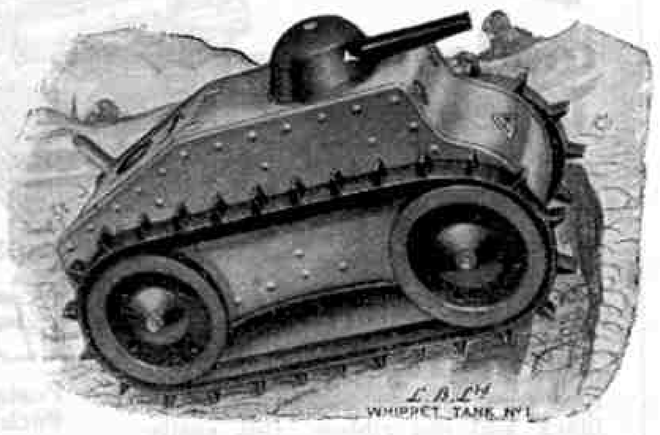

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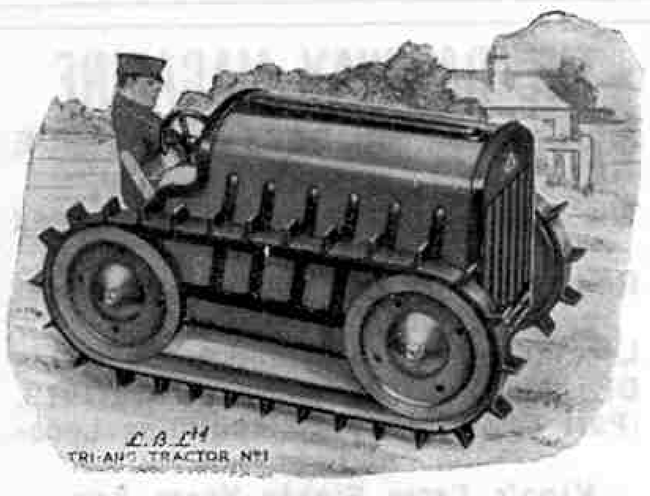

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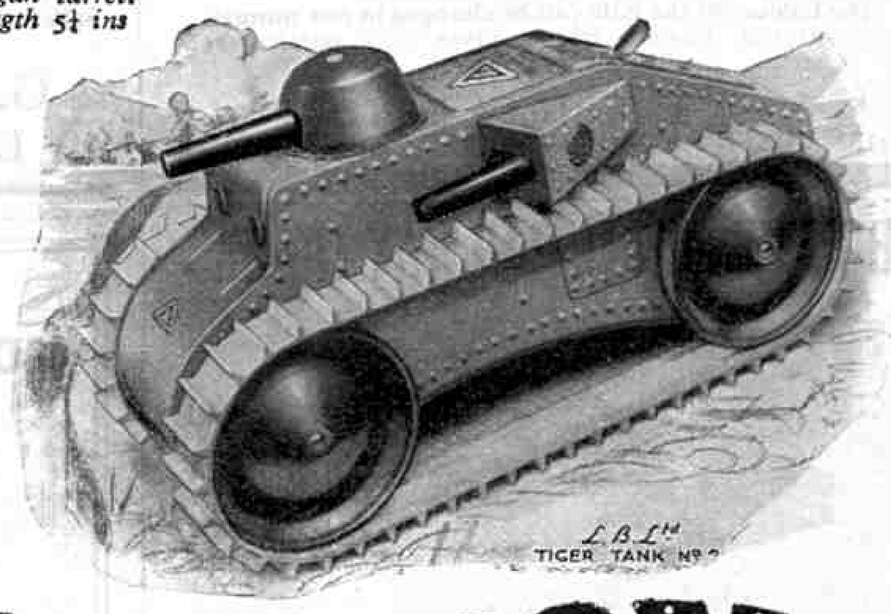

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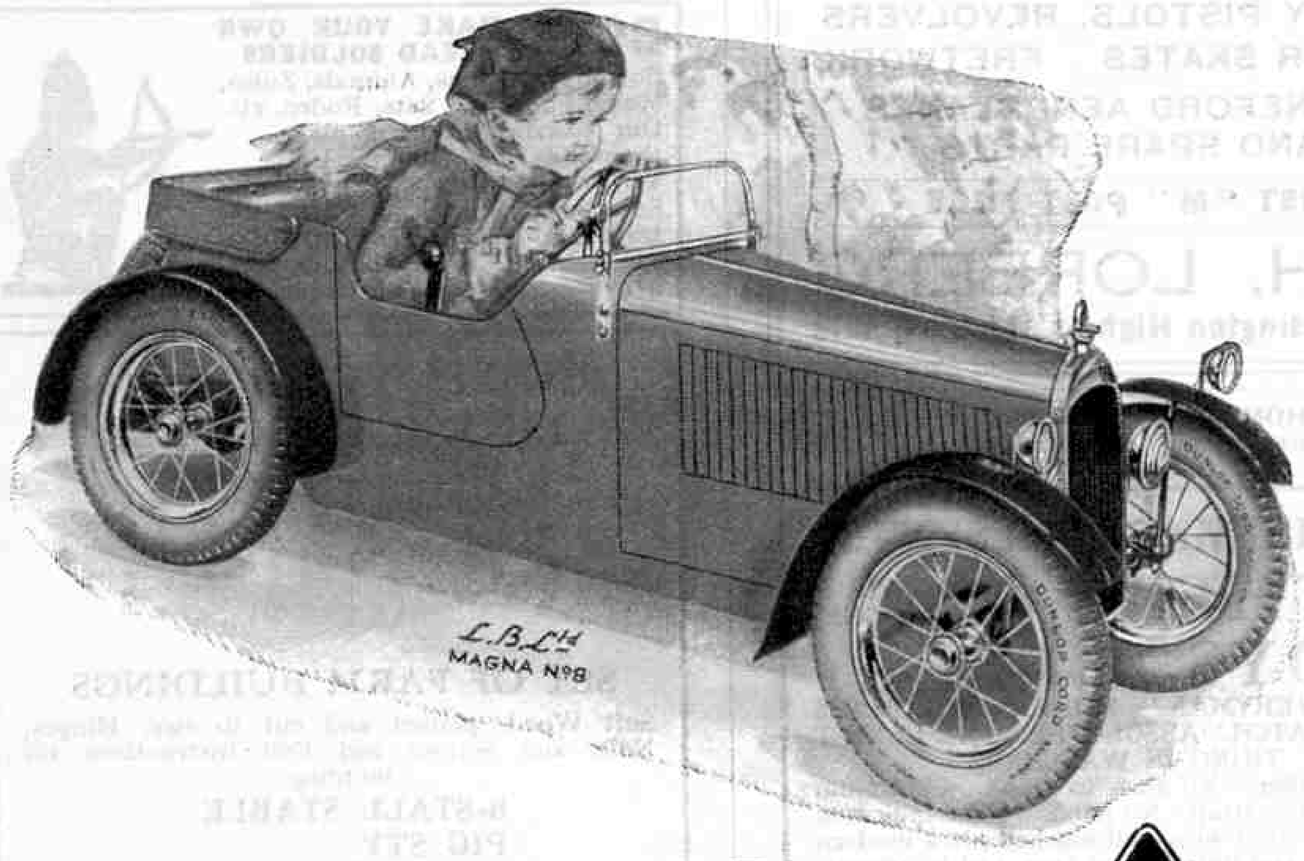

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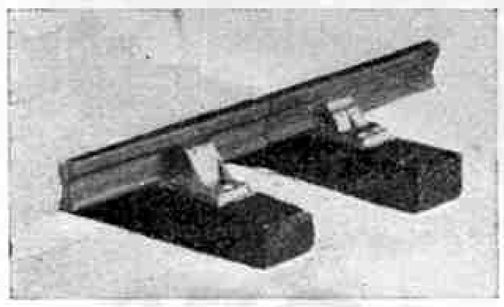

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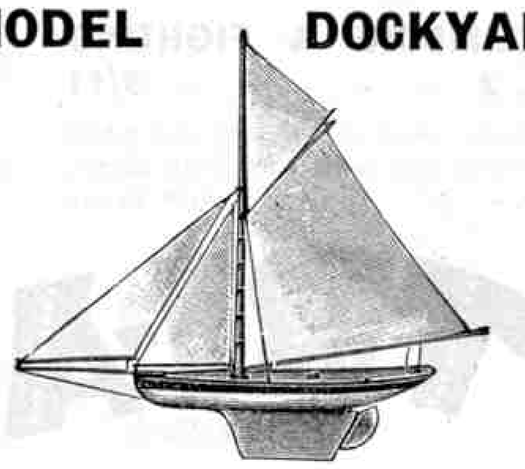

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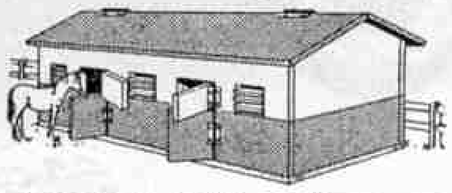

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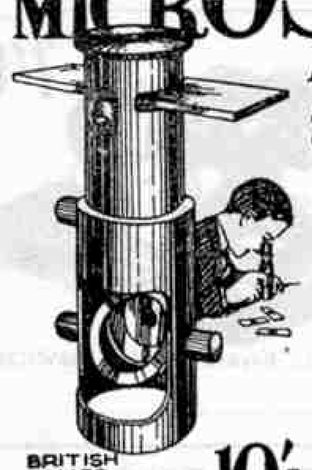

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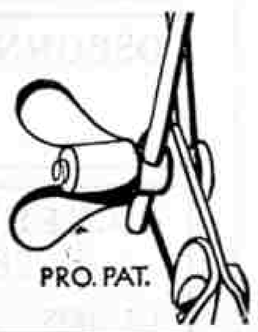

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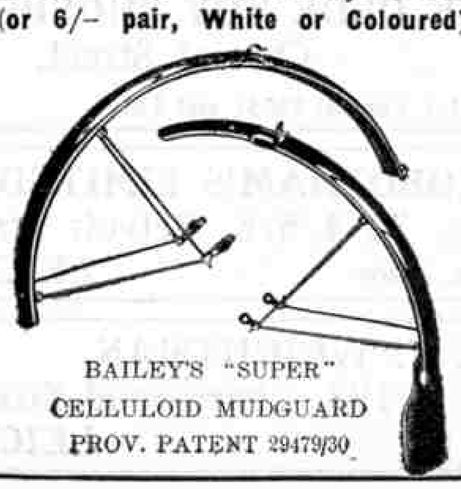

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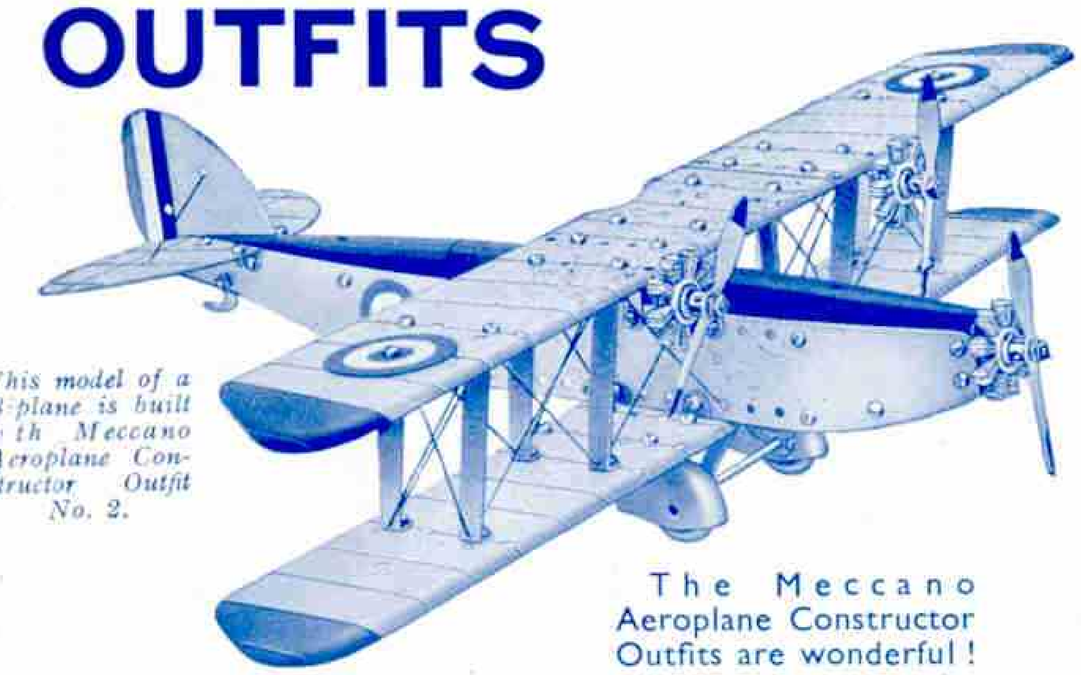

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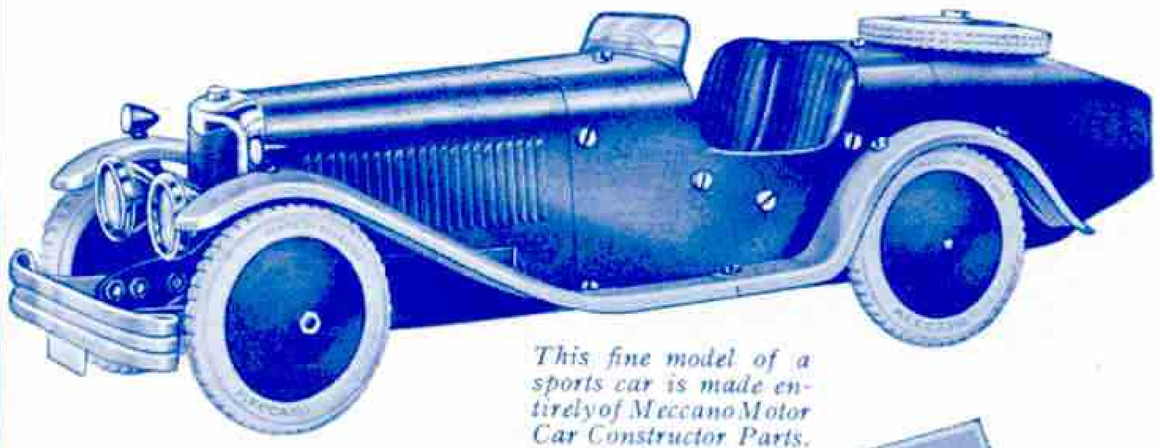

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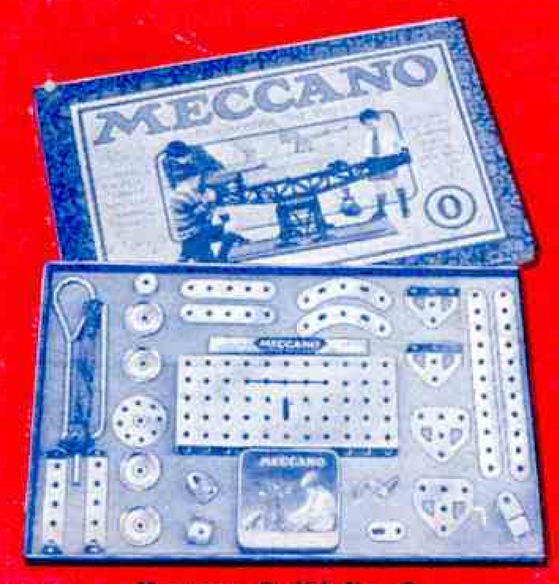

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